EVALUATION METHODOLOGY

IN TERMS OF ENVIRONMENTAL CRITERIA FOR PROJECT PROPOSALS AND ALTERNATIVES IN THE ROAD SECTOR

Sofia 2015

NCSIP
NATIONAL COMPANY
STRATEGIC INFRASTRUCTURE PROJECTS

National Company Strategic Infrastructure Projects
215 Tsar Boris III Blvd., fl. 9, Sofia, Bulgaria
phone: +359 2 42 43 931, +359 884 42 07 51
e-mail: office@ncsip.bg
www.ncsip.bg

CONTENT

I. Annotation..... 4

II. Methodology Assessment..... 4
2.1. Basic Evaluation..... 5
2.2. Detailed Evaluation..... 8

III. Evaluation Criteria..... 9
3.1. Agricultural Land..... 9
3.2. Soil and Geology..... 9
3.3. Protected areas..... 10
3.4. Air quality..... 13
3.5. Climate Change..... 14
3.6. Acoustic environment (Noise pollution)..... 16
3.7. Waste..... 17
3.8. Water quality..... 17
3.9. Landscape/Visual impact..... 18
3.10. Social effect..... 19

IV. Fundametals of methodology..... 20

Appendix A: Enviro Tool V 1.0..... **21**

Appendix B: Technical specification of the criteria, indicators, ratios and computational algorithms used in the methodology..... **36**

I. Annotation

This methodology is intended to identify general parameters, as well as technical and ecological evaluation criteria to be applied for all alternatives.

The analysis and comparison of the alternatives is carried out on the basis of quantitative and qualitative indicators, through an integrated evaluation approach, in accordance with the principle "source – impact pathway – receptor".

The evaluation criteria have been developed on the basis of estimated impacts on the environment from the implementation of the project and take into consideration the influence of road infrastructure on environmental components, which are affected and/or changed to the highest degree.

For the development of the methodology for the calculation of the base data the following documents have been used:

- Criteria for initial assessment of the impact on environmental limiting factors for Struma Motorway Lot 3, Kresna Gorge area (developed by NCSIP and presented in the Struma Motorway Development Plan, 2015);
- Struma Motorway Lot 3 – Environmental Strategy (JASPERS, 2012);
- BREF "Economics and Crossmedia Effects", European Commission, 2006;
- Design Manual For Roads And Bridges, Vol. 11 Environmental assessment, Section 3 – Environmental assessment techniques, Part 10 Road drainage and the water environment, UK Highways Agency, August 2009;
- Design Manual For Roads And Bridges, Vol. 11 Environmental assessment, Section 3 – Environmental assessment techniques, Part 1 Air Quality, UK Highways Agency, August 2009.

The methodology is developed in accordance with the basic principles and guidelines for the evaluation of environmental components and factors, according to:

- Sectoral EIA Guidelines for Motorway and Road Construction Projects, Bulgaria, JASPERS, 2013;
- Environmental Impact Assessment of National Road Schemes – A Practical Guide, National Roads Authority 2008.
- Environmental Impact Assessment of Projects, European Commission, 2013.

II. Methodology Assessment

The methodology is developed for two main assessment stages (cases), depending on the required level of detail and includes:

- Basic Evaluation (multi-criteria level of analysis);
- Detailed Evaluation (at level Evaluation of Environmental Impact and Environment)

Each option is assessed according to the evaluation criteria within the framework by using the scoring scale.

Tab. 1. Evaluation framework with scoring scale

Indicator	Weight
Construction period	**22%**
Visual Impact/Landscape Character	1
Agricultural Land	1
Protected species and habitats	4
Natura 2000 sites	4
Air Quality	2
Noise	2
Water	2
Soils and geology	2
Waste and materials	2
People and communities	2
Operation period	**17%**
Visual Impact	2
Protected species and habitats	3
Natura 2000 sites	3
Animal mortality rates	3
Air Quality	1
Noise	1
Water	1
Climate change (greenhouse gasses)	2
People and communities	1

To optimize the process of assessment and consistency in computing operations, an assessment tool Enviro Tool V 1.0. has been developed. This is a specialized tool developed in MS Excel, with the help of which the overall evaluation is made, based on criteria set in the methodology and computational algorithms.

Detailed description of Enviro Tool V 1.0 is given in **Appendix A**.

2.1. Basic Evaluation

The basic evaluation is set on the general/basic criteria and is applied for the purposes of multi-criteria analysis in a comprehensive evaluation of various alternatives.

The evaluation methodology is developed in accordance with the principles of multi-analysis and is based on two hierarchical levels (stages):

- Stage 1 –initial/preliminary evaluation (of investment alternatives);
- Stage 2 - detailed evaluation (of options of the chosen investment alternative).

The evaluation of investment alternatives is carried out on the basis of predefined ecological criteria for integrated evaluation, taking into account the possibility for occurrence of negative impact on environmental components, as well as human health, discomfort in the affected areas and the inconveniences associated with it.

2.1.1. Initial Evaluation of the Alternatives (Stage 1)

During this stage the alternatives, which are in apparent contradiction with legislative requirements and provisions (for example affecting territories with special protection and conservation status, etc.) shall be ruled out. This procedure is based on initial assessment of the so-called fatal flaws.

Fatal flaws are considered the prohibitive conditions and restrictions stipulated in the environmental legislation with respect to the protection and conservation of sites, included in the National Ecological Network. The presence of one or more fatal flaws (prohibitive conditions) shall be sufficient reason for unconditional ruling out of a given alternative. This approach allows the next evaluation stage to be focused solely on the alternative, which is realistically feasible in compliance with the environmental protection requirements.

The initial evaluation stage comprises of collection, incorporation (preparation) and analysis of existing information and data, including maps and other graphical documents of the project area and National Ecological Network sites, as well as preparation of specialized maps and layers in GIS.

For the purpose of identification of affected areas and territories with protection and conservation status the alignments of the alternatives are compared against the outlines of the protected sites in the GIS. The alignments that cross national protected areas or territories are inspected to determine whether there is a conflict or not. For example an alternative may cross a national protected area (layout) but the longitudinal profile may show that a tunnel is foreseen, hence it can be concluded that the alternative is not in apparent contradiction with the legal requirements and can be retained. The exact extent of the possible influences is to be determined at the next evaluation stage.

A/ Identification of the affected area and areas with protected status

During the initial assessment stage, an identification of potentially affected territory is being carried out, technologically based on remote sensing of the Earth's surface:

- Automated procedures in a GIS environment for selecting objects by predefined categories and criteria;

- Computer-assisted visual interpretation of vector and raster graphic data.

Processing of data volumes is in the following order:

- Formation of new layers in GIS, using restrictive conditions (protected zones, areas, etc.);
- Formation of final products (maps in electronic form) for analysis and expert evaluation.

B / Analysis and evaluation

During this phase, the collected information is systematized, summarized and analyzed and on this basis a preliminary (initial) assessment of compliance with the alternative with restrictive and/or prohibitive factors in the environment is carried out.

2.1.2 Detailed Evaluation of the Alternatives (Stage 2)

During this stage a detailed evaluation, requiring a more profound analysis, is conducted. On the basis of this analysis the acceptable from environmental point of view alternatives are prioritised. Subject of evaluation are investment alternatives, approved as acceptable during the previous assessment phase (initial/preliminary assessment)

Each alternative is evaluated in accordance with the criteria included in the evaluation framework based mostly on quantitative and some qualitative indicators.

The analysis covers the following factors:

- Air quality;
- Climate change;
- Acoustic environment (noise pollution);
- Biodiversity and Protected area;
- Natura 2000;
- Animal mortality;
- Water quality;
- Agricultural land;
- Soils and geology;
- Waste;
- Landscape
- People and communities (Social effect).

2.2. Detailed Evaluation

Essentially, the assessment is carried out on the basis of the above-mentioned basic criteria, but with a higher level of particularity and detail. It is applied for the purposes of Environmental Impact assessment (EIA) and Appropriate assessment (AA) in specialized evaluation of various alternative decisions/solutions. The proposed method cannot replace or appear as an alternative to the required specialized EIA and AA, but can be used in combination with them.

Unlike the basic evaluation, in the detailed, additional parameters are included to evaluate the components and the environmental factors, with the help of which the impact on a component is measured, based on the specific environmental conditions and way of transfer of pollutants / emissions (impact pathway) relevant to the corresponding sensitive receptors (environmental components).

The Assessment is carried out in accordance with the principles and the guidelines for evaluation of components and environmental factors, while the impact on economic factors and the social impact are not taken into consideration.

The analysis covers the following factors:

- Air quality;
- Climate change;
- Acoustic environment (noise pollution);
- Biodiversity and Protected area;
- Natura 2000;
- Animal mortality;
- Water quality;
- Agricultural land;
- Soils and geology;
- Waste;
- Landscape

III. Evaluation Criteria

10 groups of criteria, summarized in significance, have been developed and they represent basic (groups I - IX) and general (Group X). Each set of criteria contains sub criteria, characteristic in the relevant level of detail and particularity to the main (basic) criteria. Some of the parameters in the application of the criteria are quantitative, while others are qualitative.

3.1 Agricultural lands

Classification criteria

Number Criteria :	I
Categories:	-
Subcriteria:	1 pc.

№	Criteria (with addition clarification)	Indicator
1.	Affected agricultural lands	Total area (dka)

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification, based on which quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each sub criterion is described in quantitative manner and is expressed in measurement units (meters, kilometers, m^3 and etc.), as per the given indicator in the table.

It is required (if applicable) to apply graphics/maps in the appropriate scale to display the information.

3.2 Soils and Geology

Classification criteria

Number Criteria :	II
Categories:	Soils and uncultivated lands
Subcriteria:	5 pc.

№	Criteria (with addition clarification)	Indicator
1	**Soils and uncultivated lands**	
1.1	Area of the Permanent works, with permanent change in its purpose (road envelope)	Total area (dka)
1.2	Areas for construction sites (temporary) without permanent change of use – concrete plants, storage area, asphalt plants and etc.	Total area (dka)
1.3	Area roads during construction	Total area (dka)

№	Criteria (with addition clarification)	Indicator
1.4	Areas for temporary storage of excavated spoil	Total area (dka)
1.5	Areas for permanent storage of excavated spoil - construction landfills	Total area (dka)

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification, based on which quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each sub criterion is described in quantitative manner and is expressed in measurement units (meters, kilometers, m^3, dka and etc.), as per the given indicator in the table.

It is required (if applicable) to apply graphics/maps in the appropriate scale to display the information. For example, a scheme or a map with the location and the occupied area of the site for temporary and permanent storage of waste.

3.3 Protected areas

3.3.1 Biodiversity and Protected areas

Classification criteria

Number Criteria:	III
Categories:	Protected areas
Subcriteria:	4 pc.

№	Criteria (with addition clarification)	Indicator
1	**Protected areas**	
1.1	Affected protected areas	pcs.
1.2	Type of influence	directly and permanently; directly and temporary; indirectly and continuously; indirect and temporary
1.3	Percentage of the areas affected by the zone	dka / % of affected protected area
1.4	Need to change the area / regime of the protected area	Yes/No

3.3.2 National ecological network "Natura 2000"

Classification criteria

Number Criteria :	IV
Categories:	Protected areas for conservation of wild flora and fauna and natural habitats; Protected areas for conservation of wild birds.
Subcriteria:	25 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Protected areas for conservation of wild flora and fauna and natural habitats – SCI**	
Protected areas		
1.1	Affected protected areas	pcs.
1.2	Type of influence	directly and permanently; directly and temporary; indirectly and continuously; indirect and temporary
1.3	Scope of affected protected areas	dka / % of affected protected area
Natural habitats		
1.4	Affected natural habitats	pcs.
1.5	Affected natural habitats, subject of conservation in the SCI	dka / % of natural habitats
1.6	Fragmentation	Yes/No
1.7	Type of influence	directly and permanently; directly and temporary; indirectly and continuously; indirect and temporary
1.8	Priority	priority; non-priority
1.9	Conservation Status	adverse bad; adverse unsatisfactory; good
Habitats of species		
1.10	Affected habitats of species, subject of conservation in the SCI	pcs.
1.11	Type of influence	directly and permanently; directly and temporary; indirectly and continuously; indirect and temporary
1.12	Affected areas	dka / % of protected area

№	Criteria (with addition clarification)	Indicator
1.13	Fragmentation	Yes/No
1.14	Priority	priority; non-priority
1.15	Conservation Status	adverse bad; adverse unsatisfactory; good
2	**Protected areas for conservation of wild birds – SPA**	
Protected areas		
2.1	Affected protected areas	pcs.
2.2	Scope of affected protected areas	дка / % of protected area
2.3	Type of influence	directly and permanently; directly and temporary; indirectly and continuously; indirect and temporary
Habitats of species		
2.4	Affected habitats of species, subject of conservation in the SCI	pcs.
2.5	Type of influence	directly and permanently; directly and temporary; indirectly and continuously; indirect and temporary
2.6	Affected areas	dka / % of protected area
2.7	Fragmentation	Yes/No
2.8	Vulnerability	threatened; low threatened; not threatened

3.3.3 Animal mortality

Classification criteria

Number Criteria :	V
Categories:	Mortality in vertebrate species; Mortality in birds
Subcriteria:	2 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Mortality in vertebrates**	
1.1	Mortality risk in groups of species	high/moderate/low
2	**Mortality in birds**	
2.1	Mortality risk in groups of species	high/moderate/low

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification from which a quantitative and qualitative evaluations are made by the specified parameters for each criterion.

The route of the alternative/design solution, in accordance with the design specification, is applied with the help of spatial data for the affected protected areas (BG0000366 "Kresna-Ilindentsi" Habitats and BG0002003 "Kresna" Birds) of the Natura 2000 network in formats * shp. (ESRI Shape file) and * gdb. (ESRI File Geodatabase), in a coordinate system WGS 84, UTM 35 N, generated as a result of the project "Mapping and determining of the conservation status of habitats and species - Phase I".

By using the GIS software, around the aerial parts of the alternative a 200 m. wide buffer zone emerges on both sides of the track range. For this buffer (for example a strip with a width of 430 m - 400 m buffer plus the track, the size of a motorway road, which is 30 meters wide together with the roadsides) that is falling within the affected protected areas, orthophotos are developed at a scale of 1:5000, available at GIS server of The Ministry of The Regional Development (http://212.122.182.101/MRRB/). Based on these, as well as on satellite images (for example Google Earth), can be determined polygons of natural habitats and habitats of species, subject to conservation in the affected areas protected in accordance with Natura 2000 database. Based on the results the quantitative and qualitative number/ type/size of the affected key elements of protected areas are defined. Such preliminary data is subject to further field inspection.

When calculating the affected areas, including fragmentation of habitats and fragmentation of their ecotone, for output data were used the values specified in the standard forms of protected areas, as well as actual data, incl. methods and criteria of the developed methodology being the result of the project "Mapping and determining of the conservation status of habitats and species - Phase I".

Each subcriterion is described in a quantitative manner, in accordance with the indicator shown in the table.

It is required (if applicable) to apply graphics /maps in an appropriate scale to display the information. For example, scheme or image map with the location of the route regarding the National Ecological Network.

3.4 Air Quality

Classification criteria

Number Criteria :	VI
Categories:	Emissions of harmful substances into the air; Discomfort for the residents – permanent residents
Subcriteria:	4 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Emissions of harmful substances into the air**	
1.1	Mass of air pollutants released (Inventory of pollutants)	amount of pollutants such as dust (fine particles$_{10}$), nitrogen oxides (NOx) and carbon oxides (CO) in the air (Mg/km; kg/vehicles/ km; Mg$_{total}$)
1.2	Dispersion of pollutants	Predicted concentration of pollutant: dust (PM_{10}), Nitrogen oxides (NOx) and Carbon monoxide (CO) in the air (mg/m^3)
2	**Discomfort for the residents – permanent residents**	
Construction site		
2.1	Affected settlements	pcs.
2.2	Distance of the nearest village, to the construction site	meters
2.3	Duration of the construction period	year
Serving road		
2.4	Affected settlements	pcs.
2.5	Distance of the nearest village, to the truck road	meters
2.6	Duration of the construction period	year

Evaluation Methodology

A brief description is provided of the elements of the alternative/design solution, in accordance with the design specification, based on which the quantitative and qualitative evaluations are made under the given parameters for each criterion.

Each criterion is described in a quantitative manner (dimension), in accordance with the given indicator in the table.

Air pollutant emissions are calculated on the basis of the updated methodology EMEP/EEA Emission Inventory Guidebook 2013, 1.A.3.b Road transport, SNAP CODE: 0701 “Passenger cars”; 0702 “Light-duty vehicles”; 0703 “Heavy-duty vehicles”. As an additional calculation method the methodology, published in Handbook Emission Factors for Road Transport (HBEFA) may be used.

The technical guidebook for preparation of emission inventories is available at: http://www.eea.europa.eu/publications/emep-eea-guidebook-2013.

It is required (if applicable) to apply graphics/maps in an appropriate scale for displaying the information. For example, scheme or image map with the location of the route regarding the sites/settlements for protection (map with the distribution of the concentration field by kinds of pollutants); graphics of the estimated quantities of pollutants by alternatives.

3.5 Climate change

Classification criteria

Number criteria:	VII
Categories:	-
Subcriteria:	2 pcs.

№	Criteria (with addition clarification)	Indicator
1	Mass of greenhouse gases released (Inventory of greenhouse gases)	Quantity of greenhouse gasses: carbon monoxide (CO_2); methane (CH_4); and nitrogen oxide (N_2O) in (Mg/km; kg/vehicles/ km; Mg_{total})
2	Global warming	Potential of greenhouse gases: carbon monoxide (CO2); methane (CH4); and nitrogen oxide (N2O) for global warming (kg eqvCO_2)

Evaluation Methodology

A brief description is provided of the elements of the alternative/design solution, in accordance with the design specification, based on which the quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each criterion is described in a quantitative manner (dimension), in accordance with the indicator given in the table.

For calculation of the Global-warming potential (GWP) is used the methodology described in BREF "Economics and Crossmedia Effects", Chapter 2, Global Warming, European Commission, 2006.

It is required to apply graphics of the calculated quantities of pollutants and the potential of global warming by alternatives.

3.6 Acoustic Environment (noise pollution)

Classification criteria

Number criteria:	V
Categories:	Discomfort for the residents – permanent residents
Subcriteria:	3 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Discomfort for the residents – permanent residents**	
1.1	Noise emissions in the environment	Predicted noise level in dB(A) for L_{day}; $L_{evening}$; L_{night}, at the borders of residential areas or isolated houses
Construction site		
1.2	Affected settlements	pcs.
1.3	Duration of the construction period	year
Serving road		
1.4	Affected settlements	pcs.
1.5	Duration of the construction period	year
1.6	Distance to the nearest residential buildings	meters

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification from which a quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each sub criterion is described in quantitative terms (dimension), in accordance with the indicator given in the table.

It is required (if applicable) to apply graphics/maps in an appropriate scale for displaying the information. For example, scheme or image map with the location of the route, in regard with the sites/settlements for protection (noise maps); graphics; tables, used computational models, methodologies, incl. detailed description of the methods for calculating the noise emission levels.

3.7 Waste

Classification criteria

Number criteria:	VI
Categories:	-
Subcriteria:	2 pcs.

№	Criteria (with addition clarification)	Indicator
1	Amount of redundant excavated spoil	m^3
2	Quality of redundant excavated spoil (possibility for use in construction)	%

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification from which a quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each sub criterion is described in quantitative manner and is represented in measurement units (m^3), under the indicator given in the table. The "quality" is evaluated with regard to the possibility to use waste material in construction and is expressed in%.

3.8 Water quality

Classification criteria

Number criteria:	VII
Categories:	Surface water; Ground water; Risk of polluting surface and ground waters during accidents
Subcriteria:	10 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Surface water**	
1.1	Affected surface water bodies	yes/no
1.2	Distance to water body	meters
1.3	Potentially lowering the drainage capacity	yes/no
1.4	Category of the water body	I, II, III
1.5	Degree of flood risk	high; moderate; low
1.6	Connection to runoff / surface water from the roadway to the water body	direct/indirect .
1.7	Treatment / purification of surface runoff / surface water from the carriageway before discharge into the hydrographic network	type of treatment.
2	**Ground water**	
2.1	Groundwater status (1-st aquifer)	critical; at risk; good
	Affected sanitary protection zones	pcs.
2.2	Risk of contamination of ground water	high; moderate; low
3	**Risk of polluting surface and ground waters during accidents**	

№	Criteria (with addition clarification)	Indicator
3.1	Probability of incidents with the potential to cause significant pollution	acceptable risk / potential risk

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification from which a quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each sub criterion is described in quantitative terms (dimension), in accordance with the indicator given in the table.For the quantitative definition of the Risk of polluting the underground waters, is used the methodology described in the

For quantitative determination of the risk of polluting surface and ground waters during accidents is used the methodology, described in Design Manual For Roads And Bridges, Vol. 11 Environmental assessment, Section 3 – Environmental assessment techniques, Part 10 Road drainage and the water environment, Annex I, UK Highways Agency, August 2009.

It is required (if applicable) to apply graphics/maps in an appropriate scale for displaying the information. For example, scheme or image map with the location of the route, in regard with the objects for protection (sanitary protection zones); graphics and tables with the calculated risk categories.

3.9 Landscape/Visual impact

Classification criteria

Number criteria:	VIII
Categories:	Character of the surrounding terrain and visual impact
Subcriteria:	4 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Character of the surrounding terrain and visual impact**	
1.1	Landscape feature	positive; negative
1.2	Visual effects	acceptable; unacceptable
1.3	Implementation of landscape management mitigation	yes/no
1.4	Inscription of elements of road infrastructure in the surrounding terrain	acceptable; unacceptable

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification from which a quantitative and qualitative evaluations are made by the specified parameters for each criterion.

Each sub criterion is described in terms of quality, in accordance with the indicator shown in the table.

It is required (if applicable) to apply graphics/maps in an appropriate scale for displaying the information. For example, a scheme or a map with the location of the route with regard to the evaluated objects; graphics, charts and other.

3.10 Social effect

Classification criteria

Number criteria:	X
Categories:	Discomfort for the residents; Impact on local economy
Subcriteria:	5 pcs.

№	Criteria (with addition clarification)	Indicator
1	**Discomfort for the residents**	
1.1	Need to reorganize the traffic	yes/no
1.2	Duration of the reorganize traffic	years
1.3	Duration of the construction period	years
2	**Impact on local economy**	
2.1	Transport distances – Time to move to the community center / location	shorter; longer
2.2	Accessibility and communication – Communication to the community center / location	good; bad

Evaluation Methodology

Provision of a brief description of the elements of the alternative/design solution in accordance with the design specification.

Each sub criterion is described in terms of quantity and is represented in measurement units, under the indicator given in the table.

It is required (if applicable) to apply graphics/maps in an appropriate scale for displaying the information, incl. graphics, charts and other.

VI. Fundamentals of methodology

As a general rule is adopted the approach where the alternative with the least impact on the environmental components and factors, gets the most points.

The evaluation approach is based on the weight of the common environmental criteria in the overall evaluation framework (scoring scale). As a unified evaluation framework was adopted the scoring scale, applied for the purposes of multi-criteria analysis (MCA) - 40% the weight of the environmental criteria.

The total/common environmental criteria is a set of specific criteria, each of which contributes its specific weight.
Every specific criterion is made up of sub criteria.

The value of each criterion is calculated using an algorithm that takes into account the interaction between the different sub-criteria involved. To generate numerical value a set of indicators are used with the relevant coefficients, that depending on the selected parameter generate the evaluation number.

The general rule is based on an evaluation approach, where the maximum numerical value of all sub criteria, should not exceed the maximum value (weight) of the relevant basic criterion, specified in the evaluation framework.

The results are presented in the form of "overall score" and "effectiveness".

The overall score is the arithmetic average of all criteria and sub-criteria presented as a numerical value.

Efficiency is an additional tool, which describes what part of the maximum value of each criterion is reached. It is expressed as a percentage of the norm (maximum weight) of the criterion. 30 % is accepted as the minimum (threshold) value of efficiency.

It is assumed that an overall efficiency below 30% leads to the occurrence of a significant impact on the environmental components and factors and the given alternative should be considered unacceptable/risky.

Thus, design solutions or technical alternatives, despite of the clear difference in the overall scores between them, they may appear unacceptable in terms of environment, if the overall effectiveness of each is below 30%.

Also, the "effectiveness" serves as an indicator of the impact and it shows which component is the most vulnerable and where the main impact is expected. Based on this evaluation, mitigating measures could be proposed to limit the impact on a particular component or environmental factor.

Appendix B presents the technical characteristics of the used criteria in the methodology with the relevant indicators, coefficients and computational algorithms.

Appendix A

Enviro Tool V 1.0

Tool for evaluating design projects and alternatives on environmental criteria

Content

1. Introduction..... 22
1.1. System requirement 22
1.2. Program Configuration and logical sequence..... 22

2. Quick Start Guide..... 23

1. Introduction

Enviro Tool V 1.0 is an evaluation tool created for the purposes of this methodology in MS Excel environment. This is a specialized tool with the help of which an overall assessment is made, based on the criteria set out in the methodology and the computational algorithms.

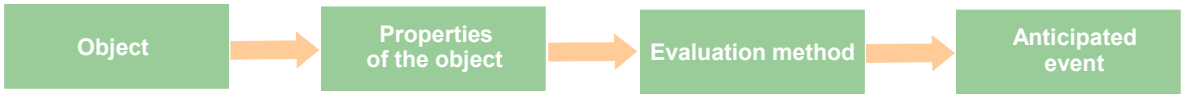
Enviro Tool V 1.0 is the product of object-oriented programming, created in VBA (Visual Basic for Application) - visually object-oriented high-level programming language.

1.1. System Requirements:

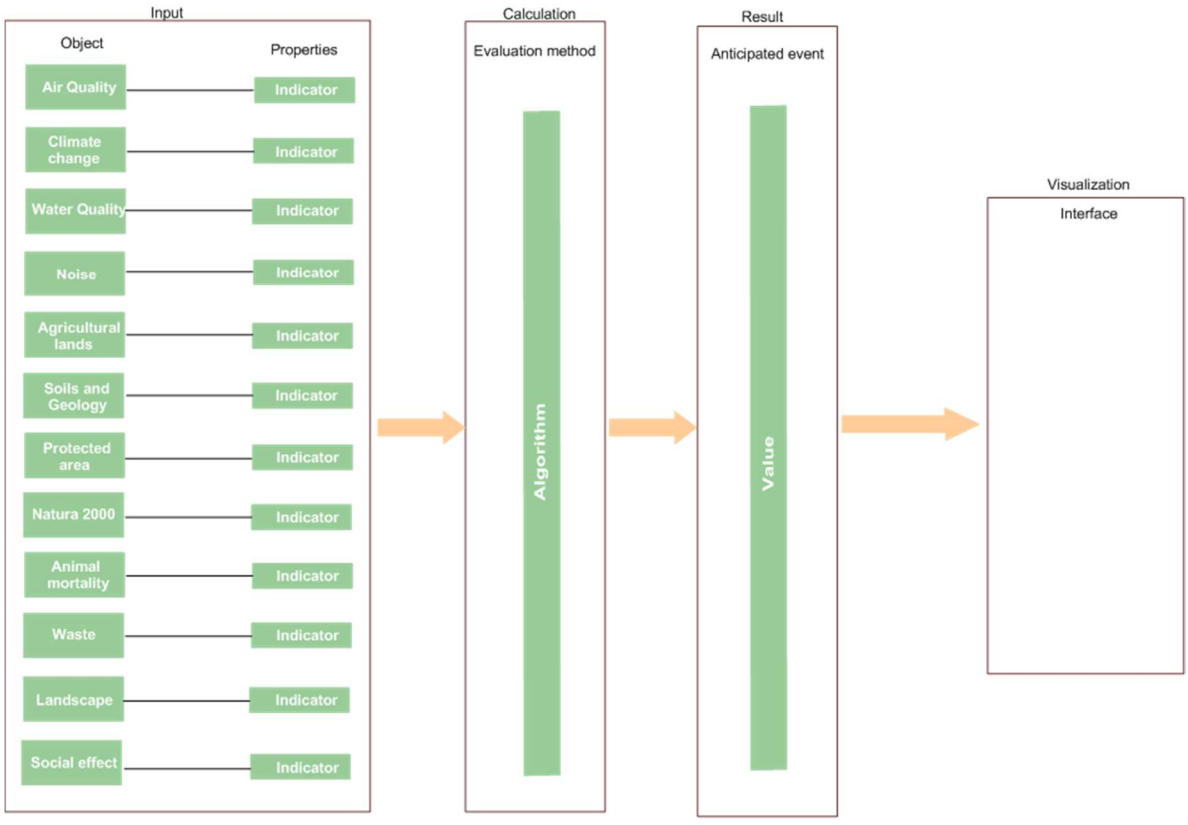
- Windows 7;
- Microsoft Excel 2013 or above

1.2. Program Configuration and logical sequence

The program is structured on the principle of logical connection between the object under assessment (environmental component/factor); the properties of the assessed object (variables); assessment method (algorithm); and the anticipated event (the result of the assessment method)



Each object is presented as a separate unit and is spatially oriented object. In turn, each module is programmed to perform a coherent set of instructions, enabling the algorithm to solve a specific task in a logical sequence.



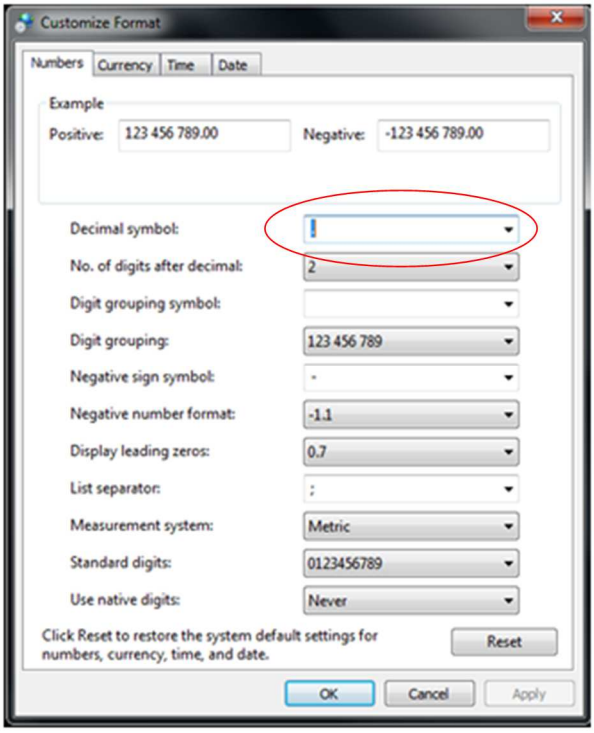
The visualization of individual elements of the program and the calculated results is done by using an interface that provides quick and easy access to the various menus and sub-menus in the program. The program's interface is easy and convenient to use (User friendly), and includes a set of keys and buttons for quick access to menus, information windows, optional buttons and other instruments through which the work process is guided. For users 'convenience special additional

buttons have been created (Help buttons), that provide additional guidance for a specific parameter or function of the program. Also, special mechanisms are provided to ensure the reliability of the results obtained by directing and guiding the process in the required sequence and in order to avoid mistakes.

2. Quick Start Guide

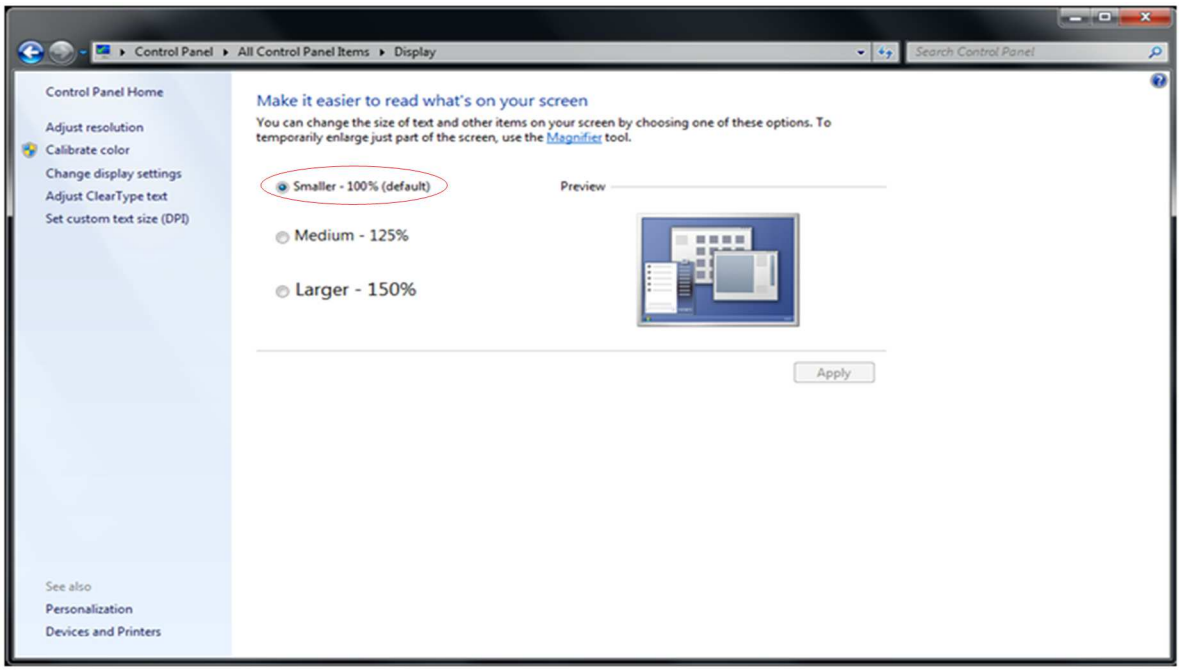
Step 1

Change the decimal settings on your computer from "Regional settings" from a comma (,) to dot (.)



Step 2

Change the text and icon size on your monitor from “Control panel Home” – “Display” – “Smaller – 100% (default)”

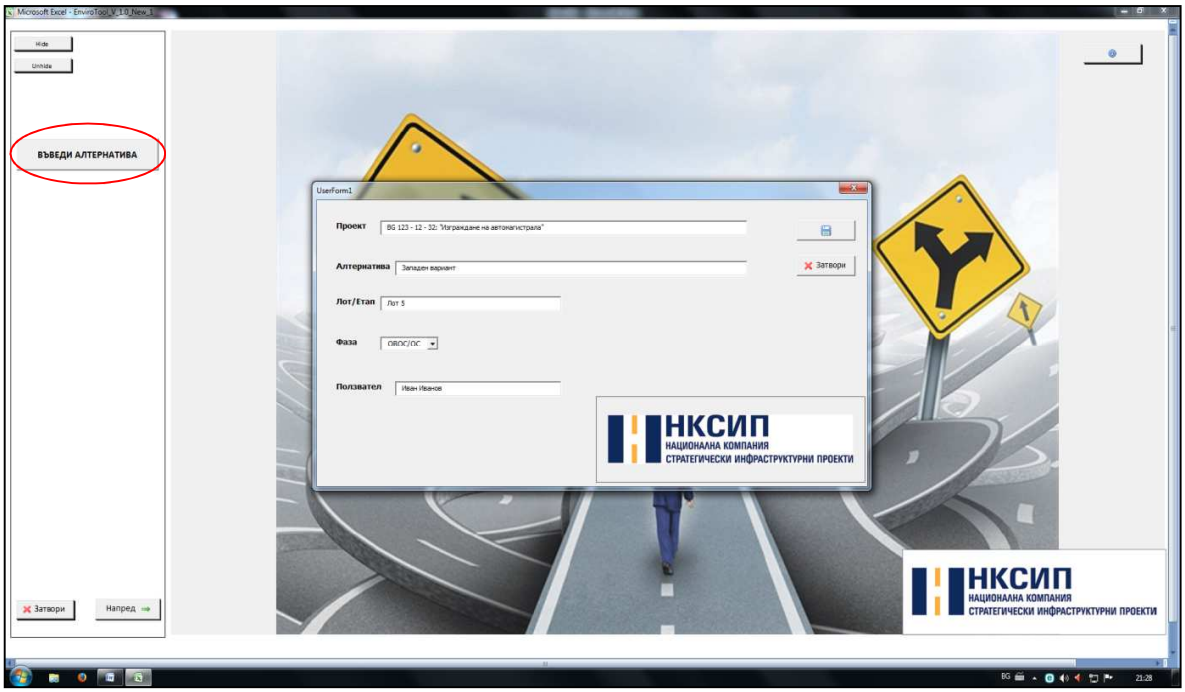


Step 3

Start the program – EnviroTool_V_1.0_xlsm

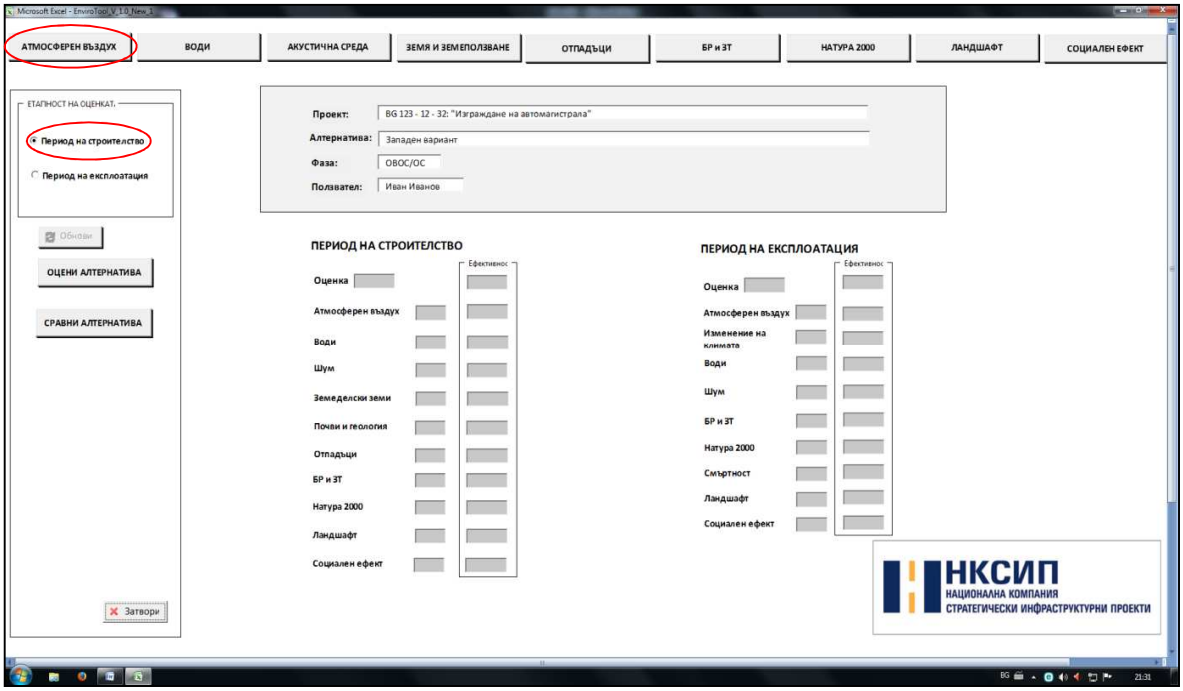
Step 4

Enter the name of the object and the phase/stage of evaluation in the dialog window by pressing the button  "enter alternative"



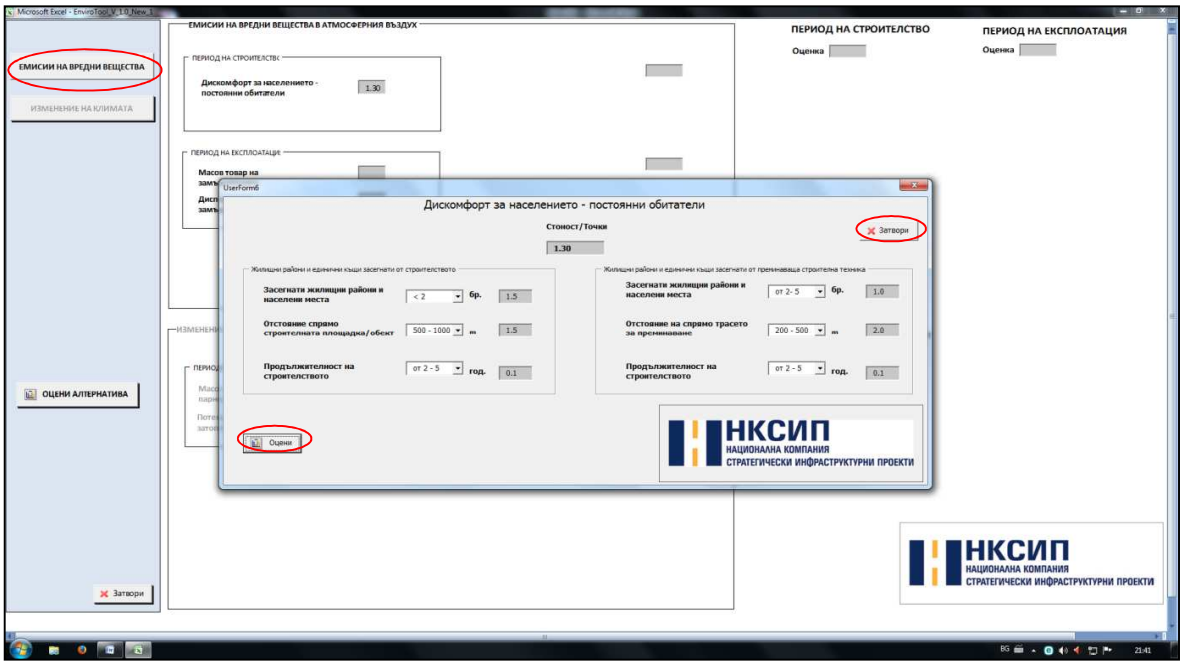
Step 5

Choose the period/stage of evaluation from optional button [Период на строителство] "construction period". Start the evaluation module for the first criterion [АТМОСФЕРЕН ВЪЗДУХ] "Air"



Step 6

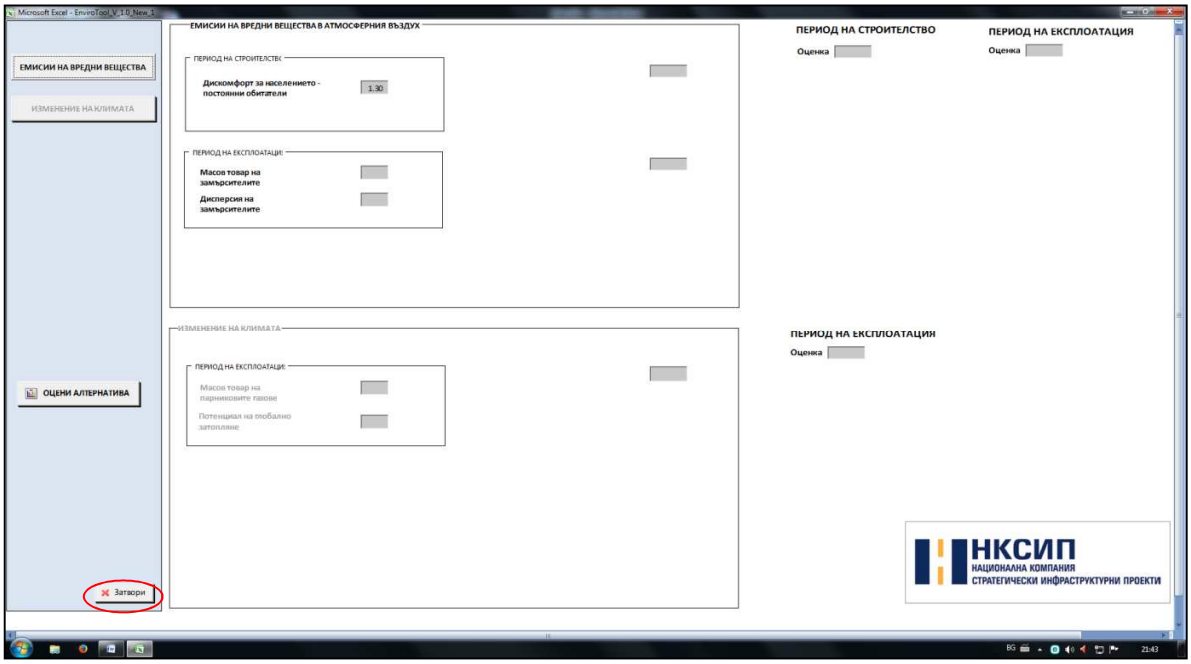
Press the ЕМИСИИ НА ВРЕДНИ ВЕЩЕСТВА "harmful substances emissions" button and from the dialog box choose the relevant parameters/indicators from the drop down menu (pop-up menu). After the data is chosen, press the button Оцени "evaluate". To complete the evaluation in this module, press the Затвори "close" button.



"Climate change" button is active only during the evaluation stage: " Exploitation period"

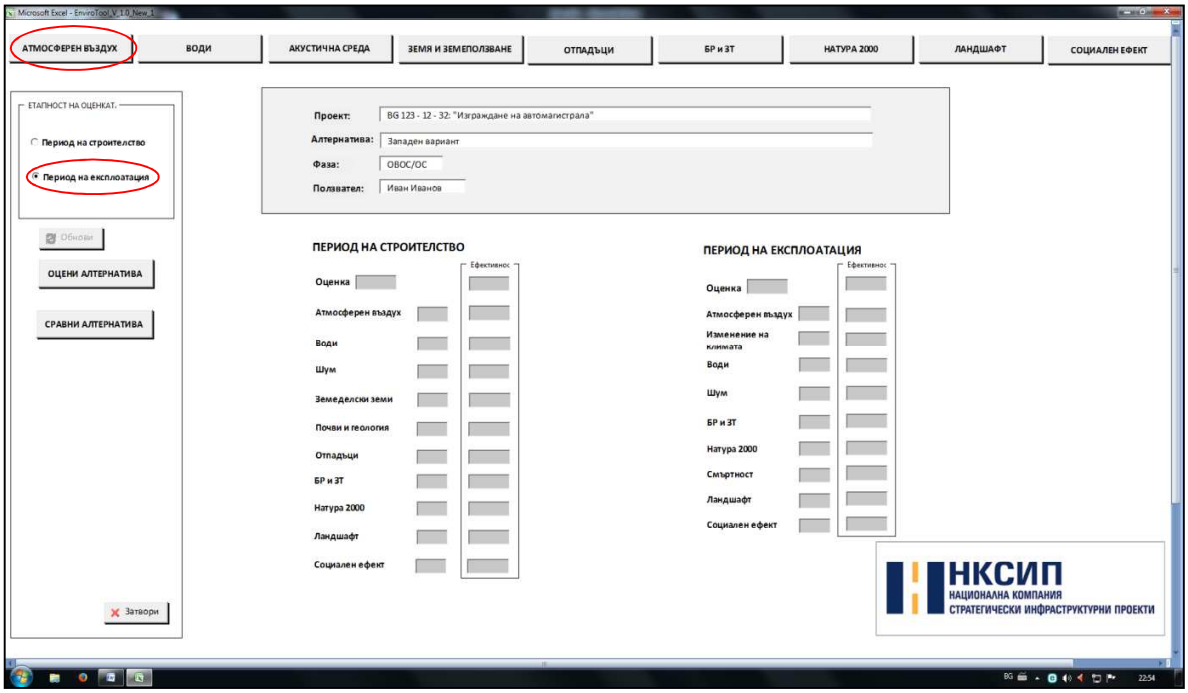
Step 7

To go back to the main menu of the program, press the Затвори "close" button.



Step 8

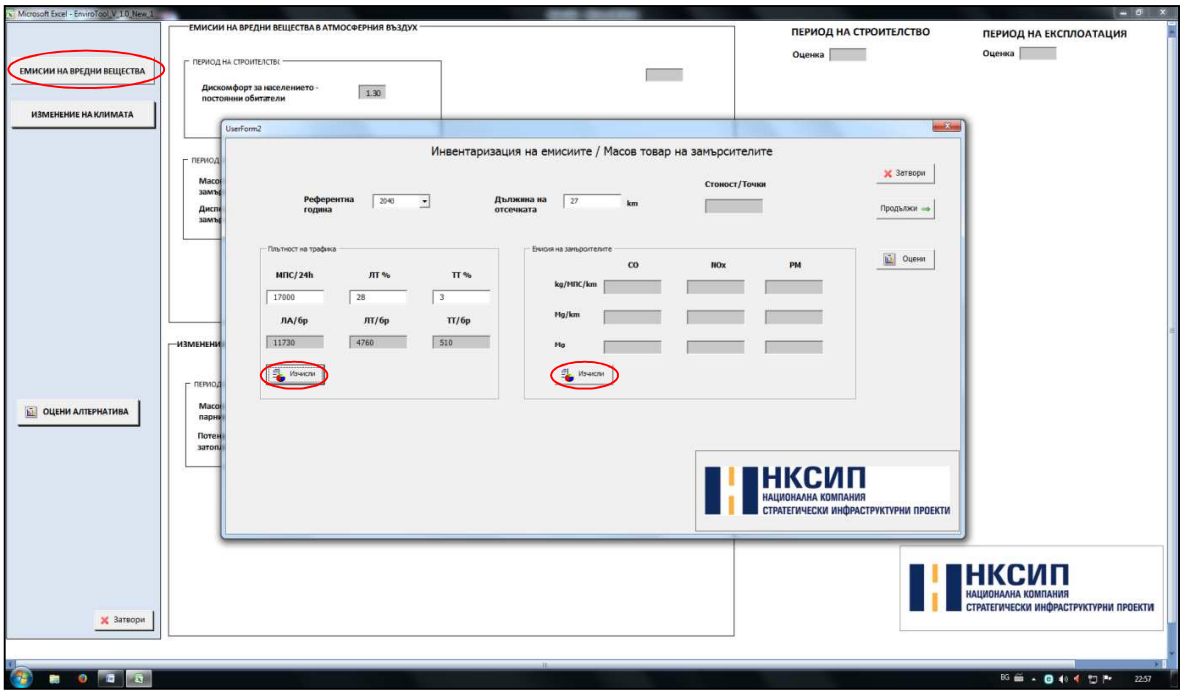
Select the next evaluation phase/stage from optional button Период на експлоатация "exploitation period". Start again the evaluation module for the first criterion АТМОСФЕРЕН ВЪЗДУХ "Air".



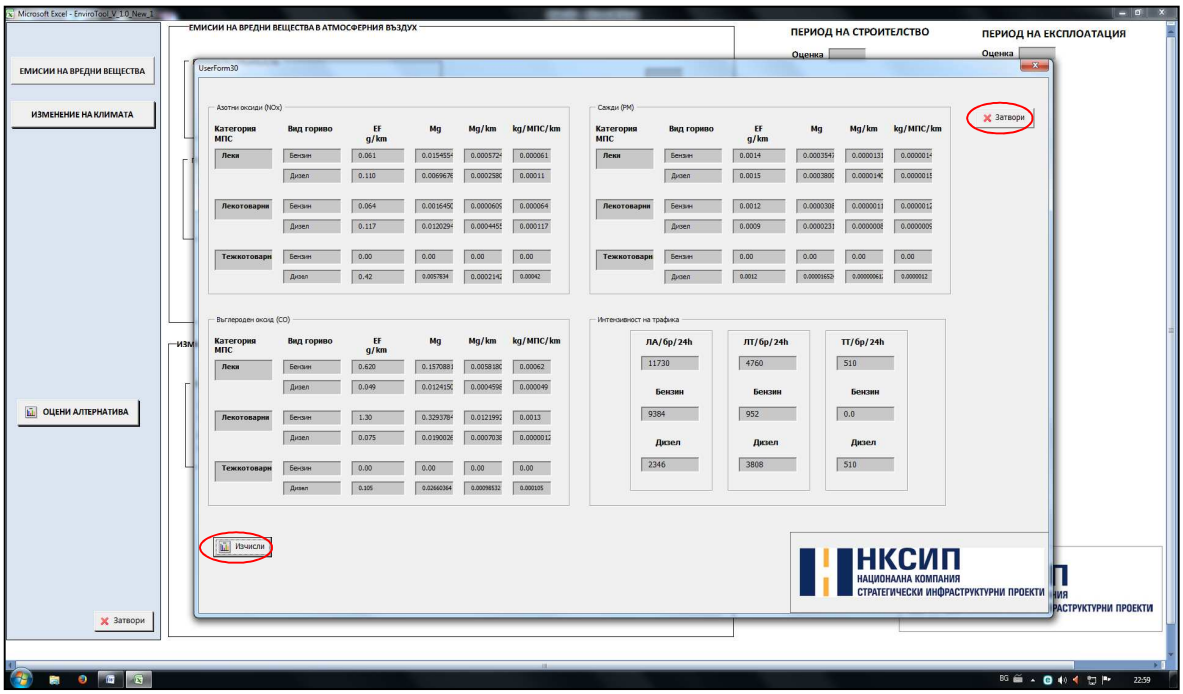
Step 9

Press the ЕМИСИИ НА ВРЕДНИ ВЕЩЕСТВА "harmful substances emission" button and in the dialog box that appears, select and fill in the relevant parameters/indicators from the buttons in drop-down (pop-up) menu.

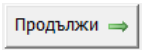
In the sub-menu "traffic intensity" fill in the blanks with information about the density of traffic, respectively number of Motor Vehicles/24h (AADT); % Light-duty vehicles (LV); % Heavy-duty vehicles (HV). After finishing filling out the data, press the Изчисли "Calculate" button.



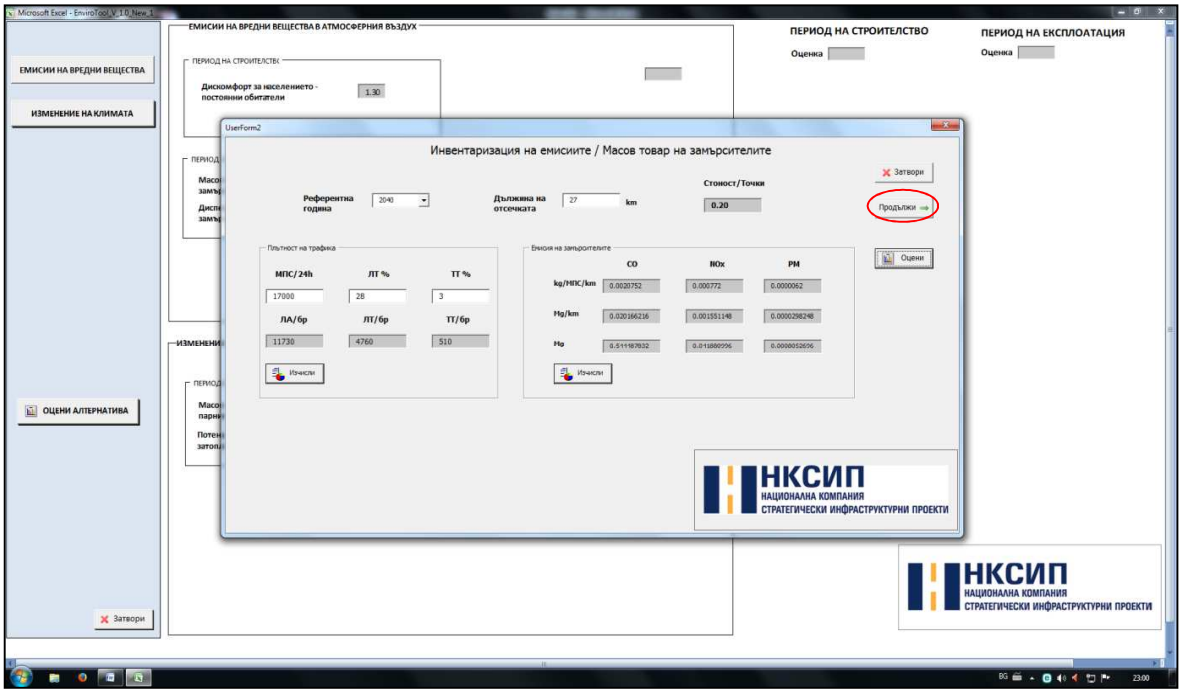
To fill in the data in the "'Harmful substances emissions" submenu, press the Оцени "evaluate" button. In the dialog box that appears, press the Изчисли "Calculate" button, after that press Затвори "close" button. From the buttons in the right-hand corner of the dialog window, press Оцени "evaluate".



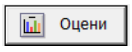
Step 10

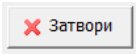
To go to the next evaluation stage, press the “continue” button 

. In the dialog box, choose the relevant parameters/indicators from the buttons in the drop-down menu.

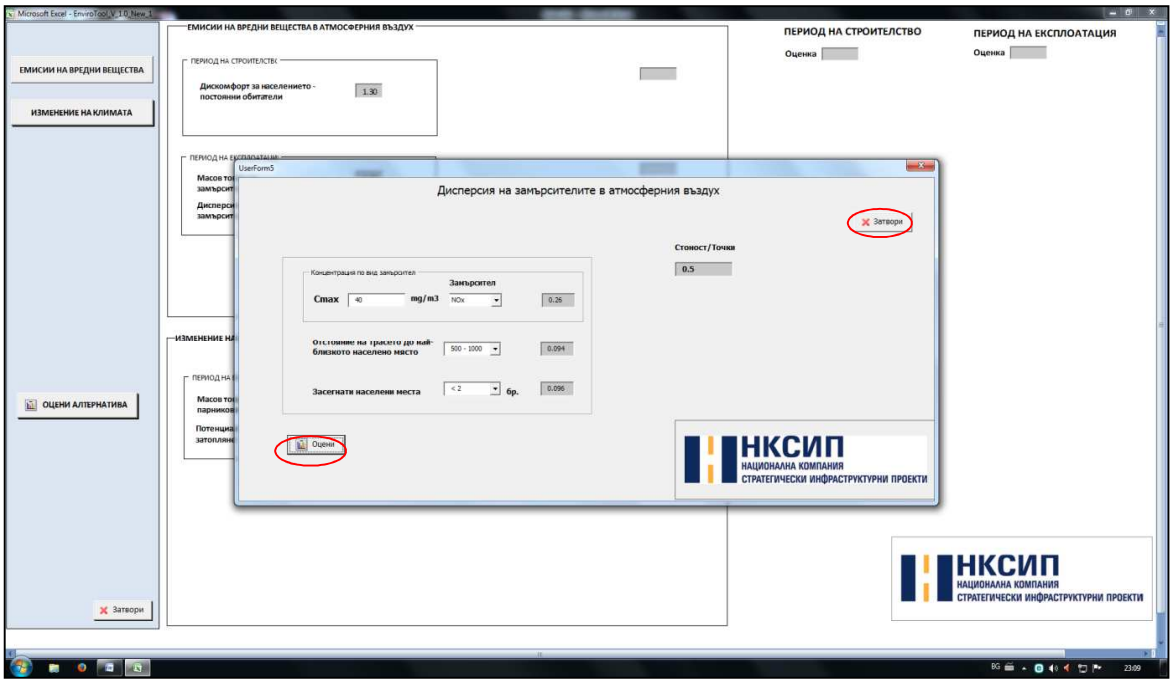


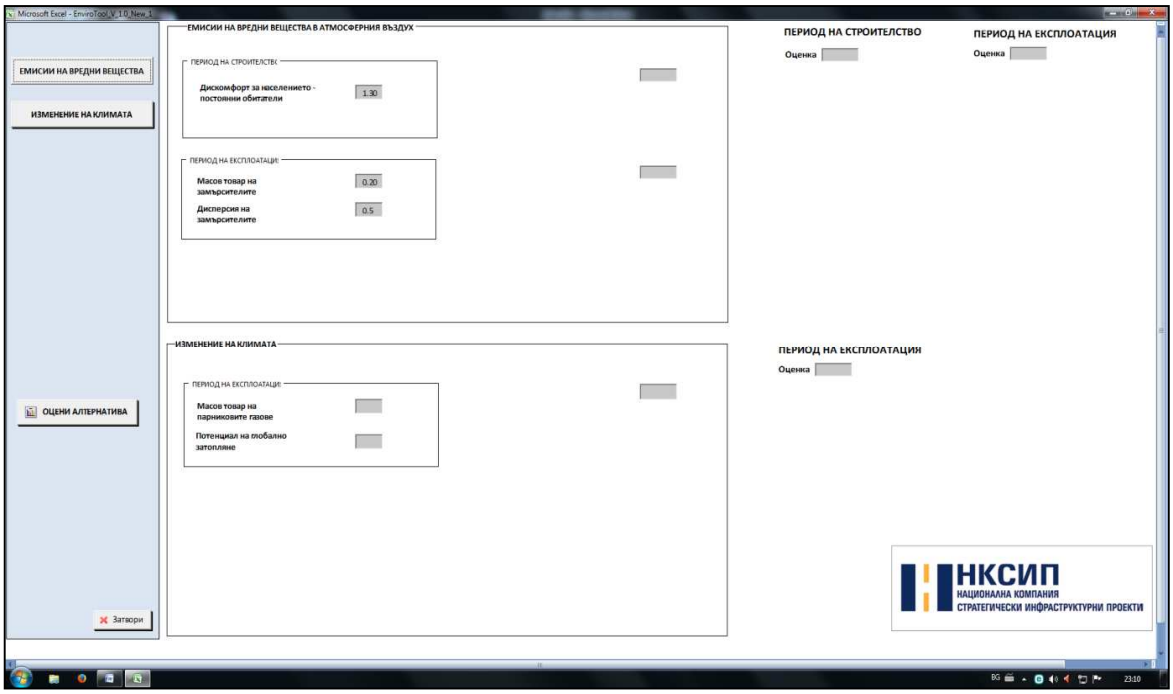
Step 11

After the data is selected, press the “evaluate” button 

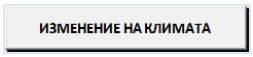
. To finish the evaluation in this module press the “close” button 

.

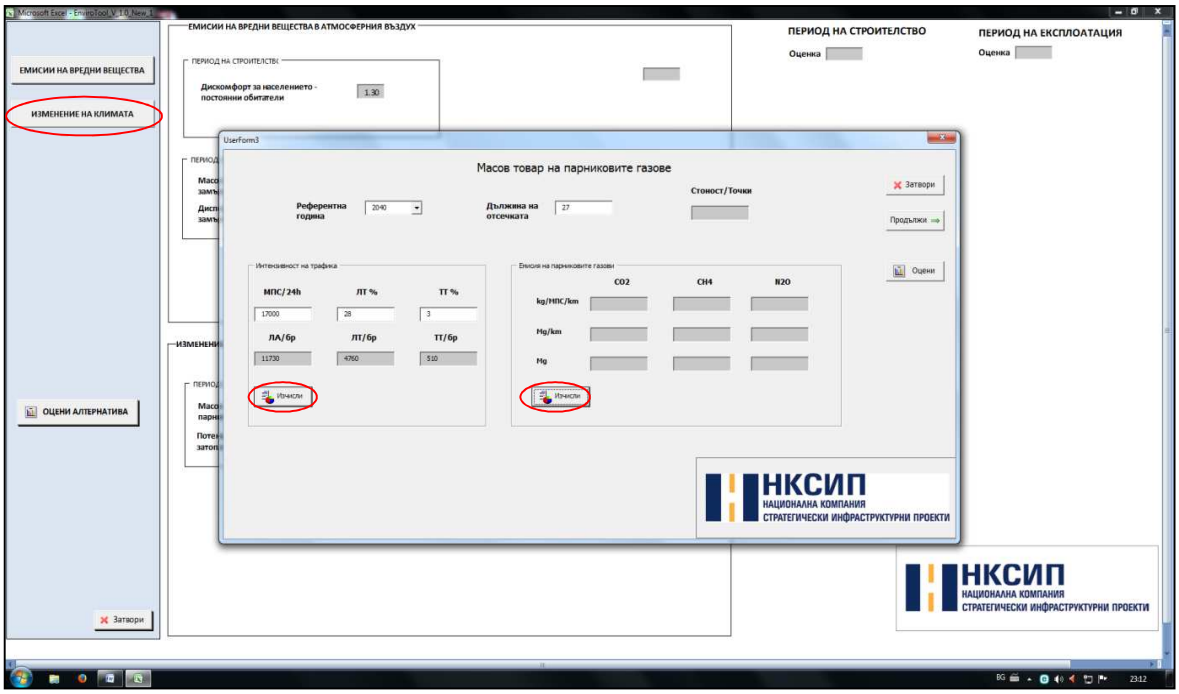


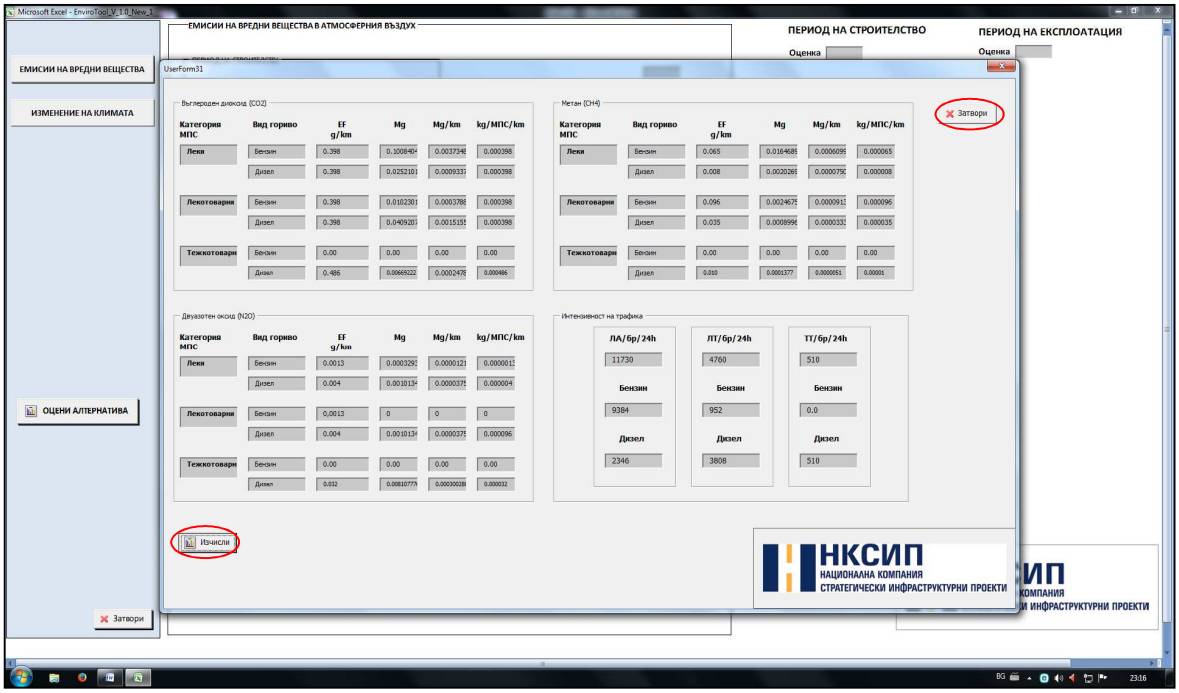


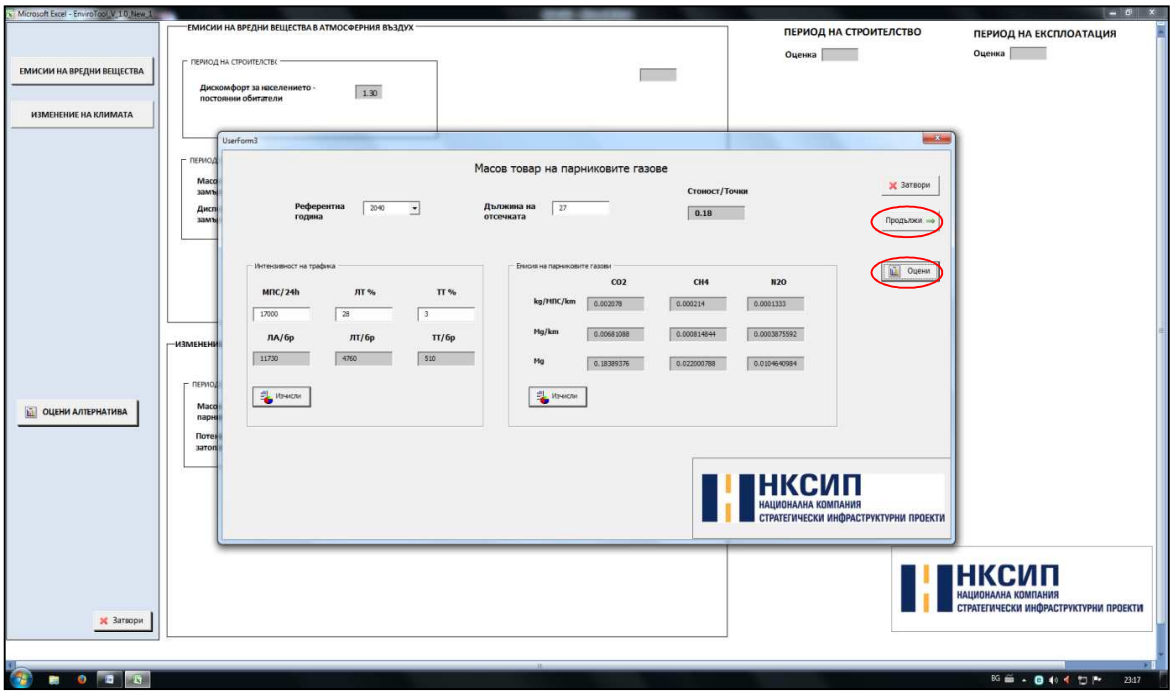
Step 12

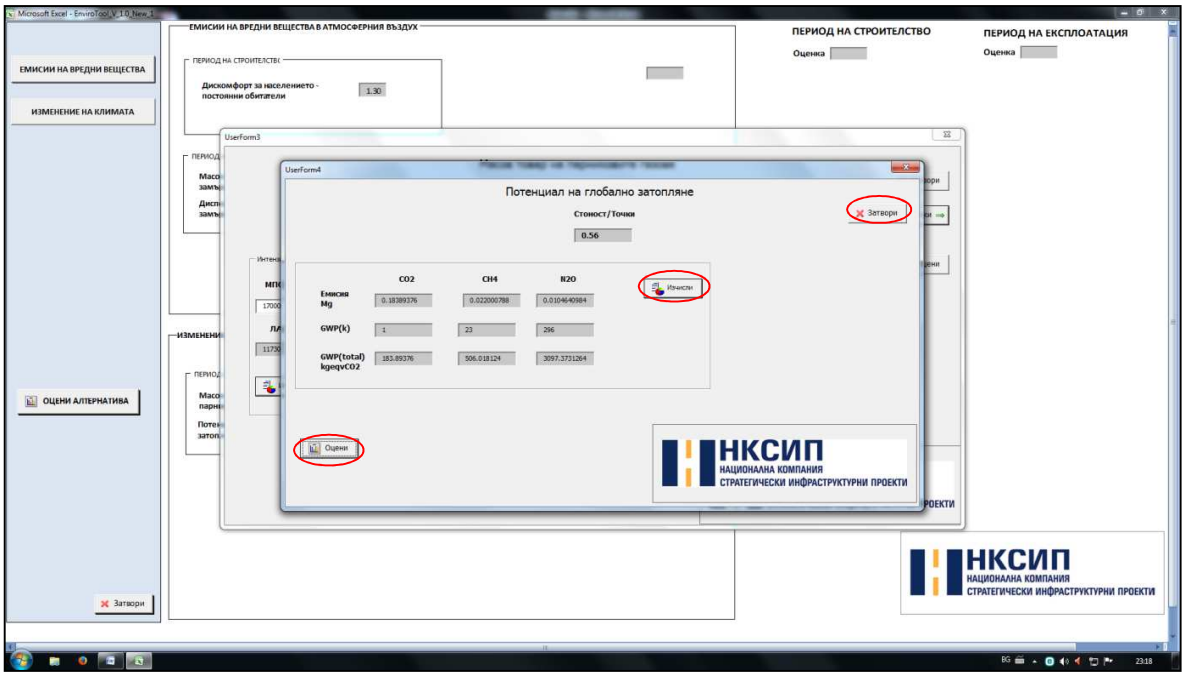
by pressing the “climate change” button 

. Repeat the operation from step 10-11.




ЕМИСИИ НА ВРЕДНИ ВЕЩЕСТВА В АТМОСФЕРНИЯ ВЪЗДУХ
ПЕРИОД НА СТРОИТЕЛСТВО
ПЕРИОД НА ЕКСПЛОАТАЦИЯ
Оценка
ЕМИСИИ НА ВРЕДНИ ВЕЩЕСТВА
ИЗМЕНЕНИЕ НА КЛИМАТА
ОЦЕНИ АЛТЕРНАТИВА
Затвори
UserForm31
Изчисли
НКСИП
НАЦИОНАЛНА КОМПАНИЯ
СТРАТЕГИЧЕСКИ ИНФРАСТРУКТУРНИ ПРОЕКТИ

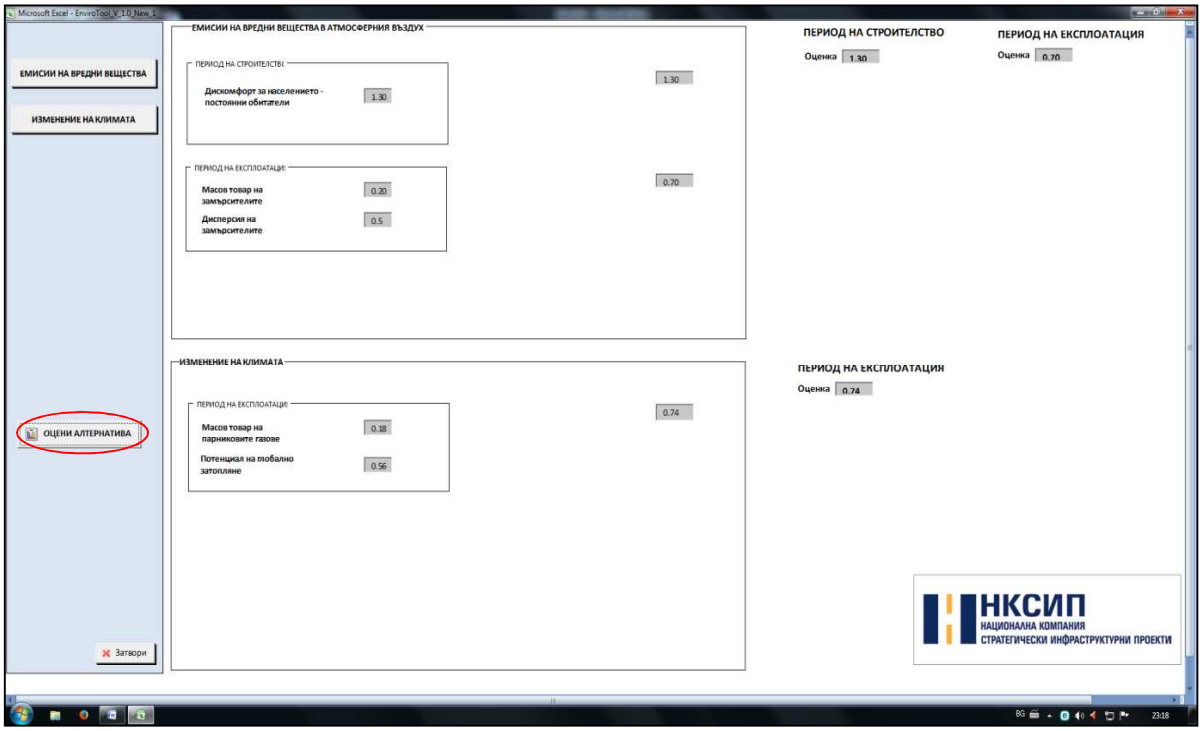

ЕМИСИИ НА ВРЕДНИ ВЕЩЕСТВА В АТМОСФЕРНИЯ ВЪЗДУХ
ПЕРИОД НА СТРОИТЕЛСТВО
ПЕРИОД НА ЕКСПЛОАТАЦИЯ
Оценка
ЕМИСИИ НА ВРЕДНИ ВЕЩЕСТВА
ИЗМЕНЕНИЕ НА КЛИМАТА
ОЦЕНИ АЛТЕРНАТИВА
Затвори
UserForm3
Масов товар на парниковите газове
Референтна година
Дължина на отсечката
Стоност/Точки
Продължи
Оцени
Изчисли
НКСИП
НАЦИОНАЛНА КОМПАНИЯ
СТРАТЕГИЧЕСКИ ИНФРАСТРУКТУРНИ ПРОЕКТИ



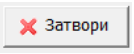
Step 13

To generate the numeric value for ''Air" and "Climate change" during construction and exploitation, press the ''Evaluate Alternative'' button 

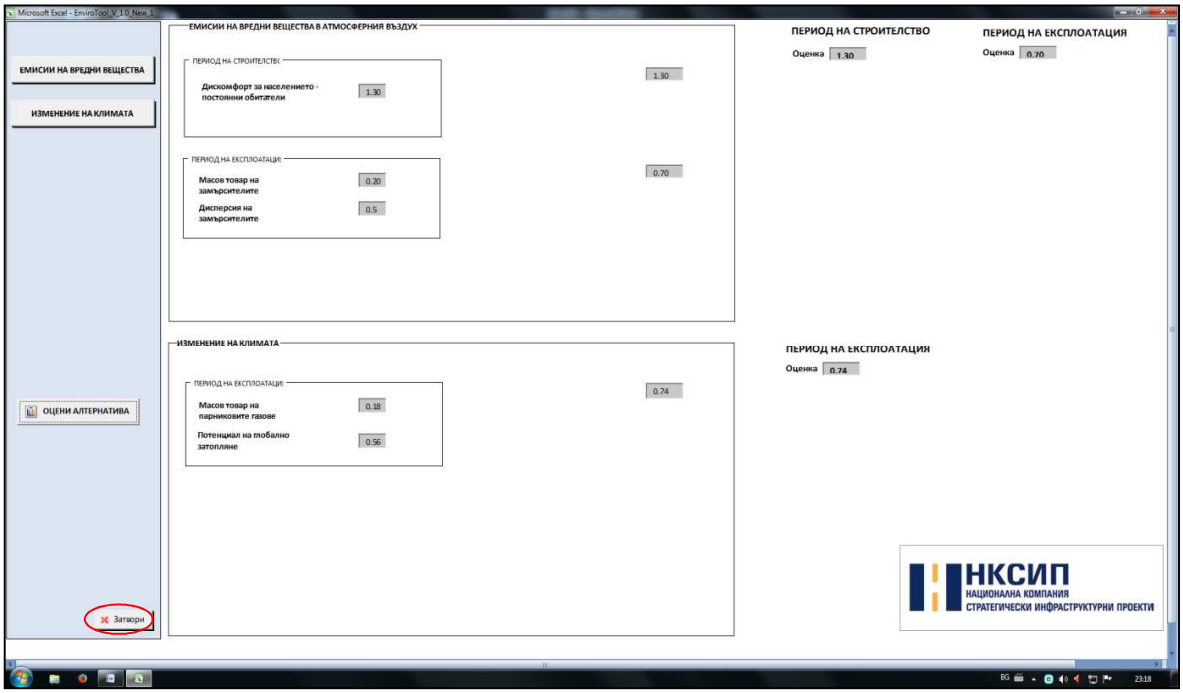
.



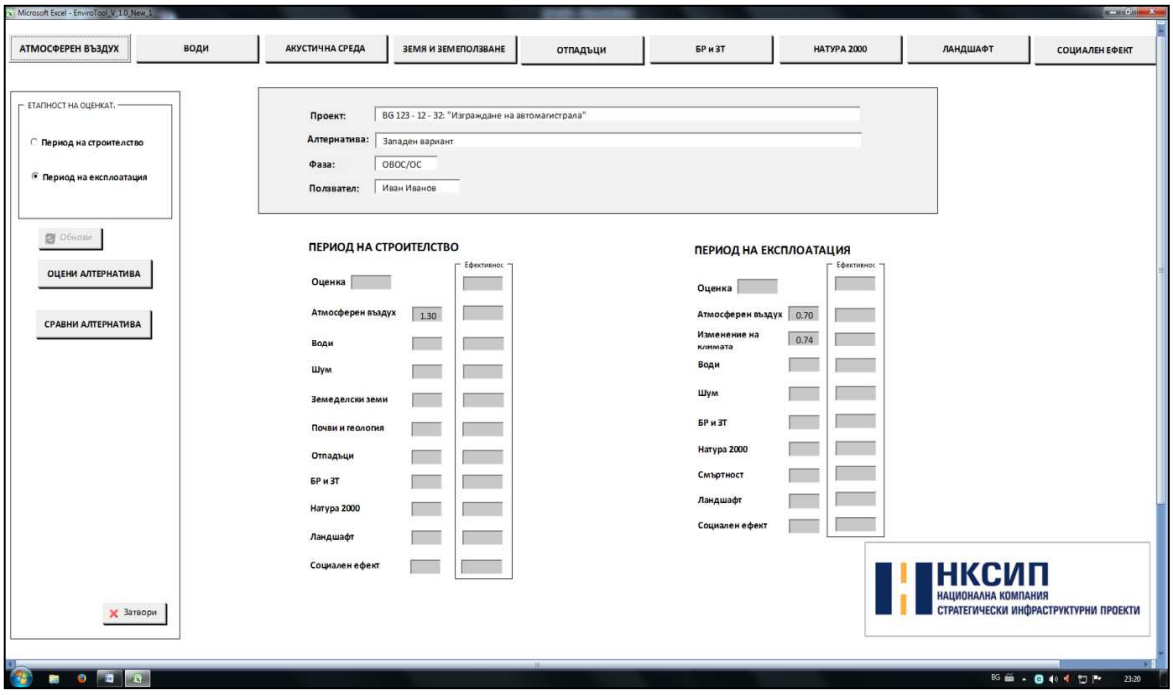
Step 14

To go back to the main menu of the program, press the “close” button 

.

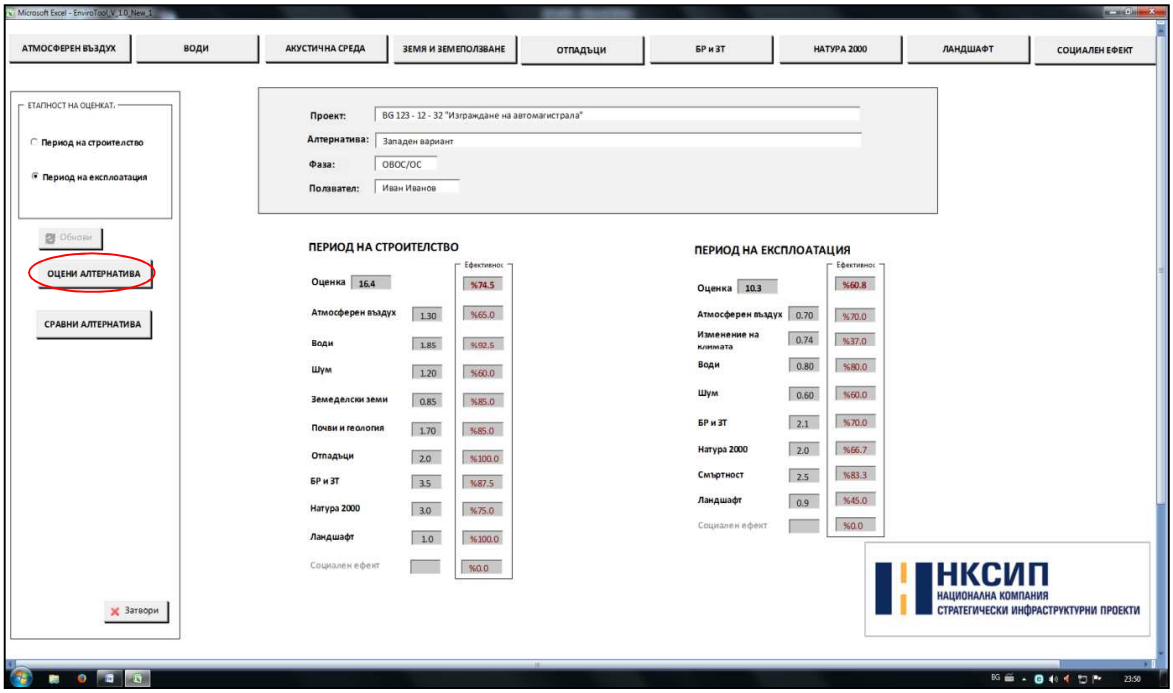


The results from the evaluation in “Air ” and “Climate change” are automatically filled in the text windows in the main menu.



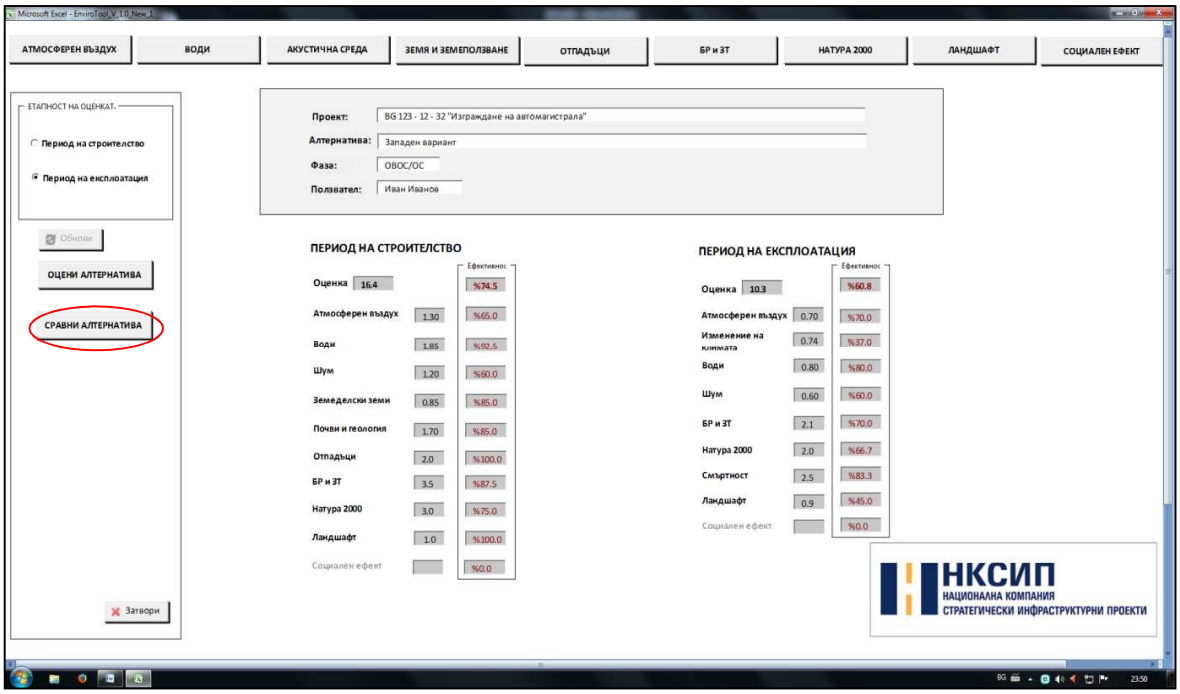
For an overall evaluation of all environmental criteria, the following operations are carried out - Steps 5-14, similar to the evaluation in "Air" and "Climate Change" criteria.

After the completion of the evaluation for an alternative (design solution) in all environmental criteria, click the "evaluate alternative" button ОЦЕНИ АЛТЕРНАТИВА from the main menu. In the text windows automatic calculation is carried out of the overall value of alternatives for different periods of evaluation (period of construction and exploitation), individual overall environmental evaluation for each ecological criterion, as well as the overall and the individual effectiveness of the alternative .

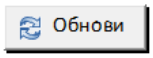


To enter and evaluate a new alternative (design solution), click the “close” button Затвори from the main menu and repeat steps 4-14.

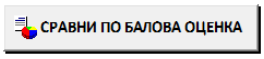
After the data is entered and the selected alternatives evaluated (maximum number of alternatives -6), click “compare the alternative” button СРАВНИ АЛТЕРНАТИВА from the main menu.

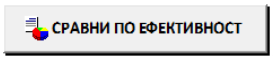


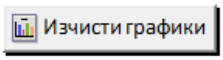
The maximum number of alternatives for evaluation is 6 and after that the “evaluate alternative” button 

becomes inactive. To remove the entered data for the alternatives, click the ”refresh” button 

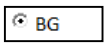
.

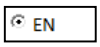
In the submenu that appears there is an option for graphic visualization of the results from the evaluated alternatives, depending on the user’s preferences, by clicking the “compare by overall value” 

and “compare by efficiency” 

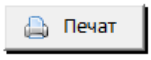
. To clear the graphics, click the “ clear graphic” button 

.

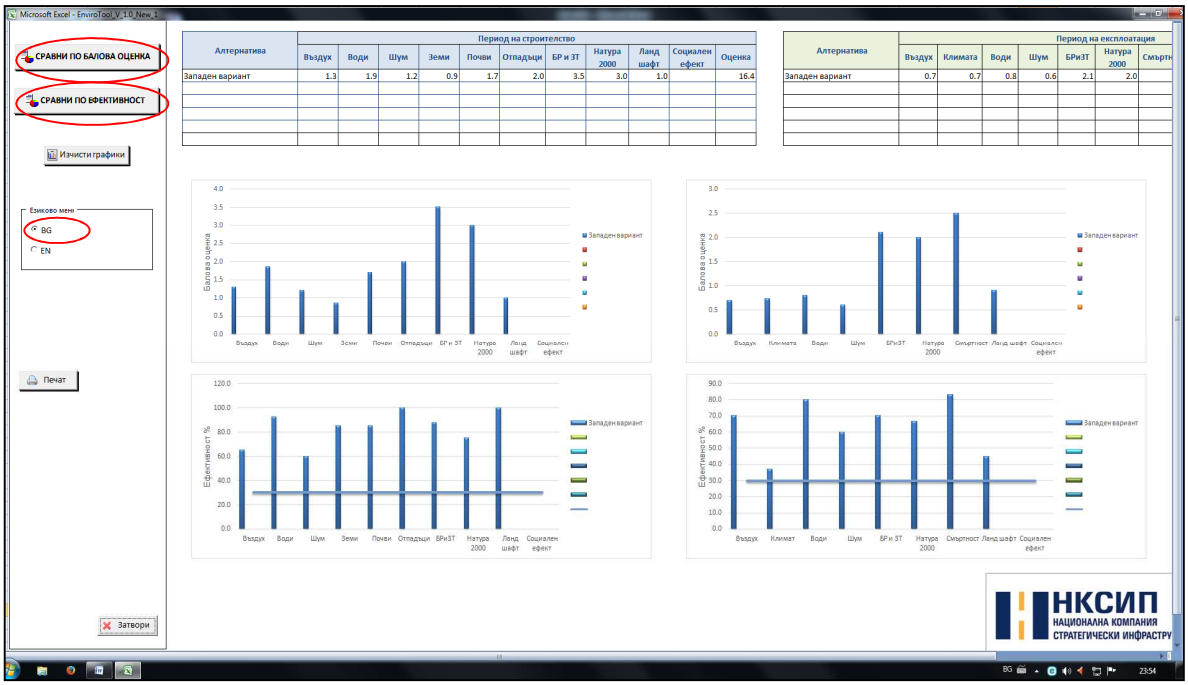
From the optional buttons in the language menu 

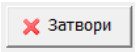
“BG” and 

“EN”, the user can select the working language.

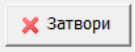
The program can generate a printed report with the results from the evaluation, by clicking on the "Print" button 

.



To go back to the main menu, click the “close” button 

.

To close the program, press the “close” button 

in the main menu and in the start menu.

Do not use “X” from the MS Excel menu  **to close the file!!!**

Appendix B

Technical specification of the criteria, indicators, ratios and computational algorithms used in the methodology.

Contents

1. Annotation..... 37

2. Multi-criteria analysis (MKA)..... 40
2.1. Construction period..... 40
2.2. Operation period..... 46

3. Environmental impact assessment (EIA/AA)..... 53
3.1. Construction period..... 53
3.2. Operation period..... 60

I. Annotation

Within the core of the methodology are computational algorithms capable to interpolate numerical values of relevant criteria, based on indicators and ratios. To generate a numerical value, a set of indicators are used, with the relevant coefficients, that depending on the selected parameter generate an evaluation number.

The value of each criterion is calculated with the help of an algorithm that calculates the interaction of different sub criteria involved.

Sub criteria are involved with a certain numerical value depending on the severity (importance) of the respective sub criterion, when describing the main criterion.

For example, in evaluating in criterion "waste and waste materials," the main criterion is characterized by two sub - "Quantity of generated excess earth and rock mass" and "Potential to utilize in construction."

The advantage is given in the sub-criterion "Potential to utilize in construction", which receives 60% or 1.2 of the total value (weight) of the basic criterion (2.0), since it is assumed that the main importance falls on prevention and the options for utilization of waste materials, rather than its quantity. In other words, the better alternative is always the one that provides greater opportunity to utilize and reuse of waste material, than the one with smaller quantities of generated waste, but with low utilization percentage. The higher the utilization percentage is, the less is the generated amount of final waste.

To obtain the numerical expression of each sub criterion, an indicator is used, which depending on the selected parameter, generates a number (numerical ratio).

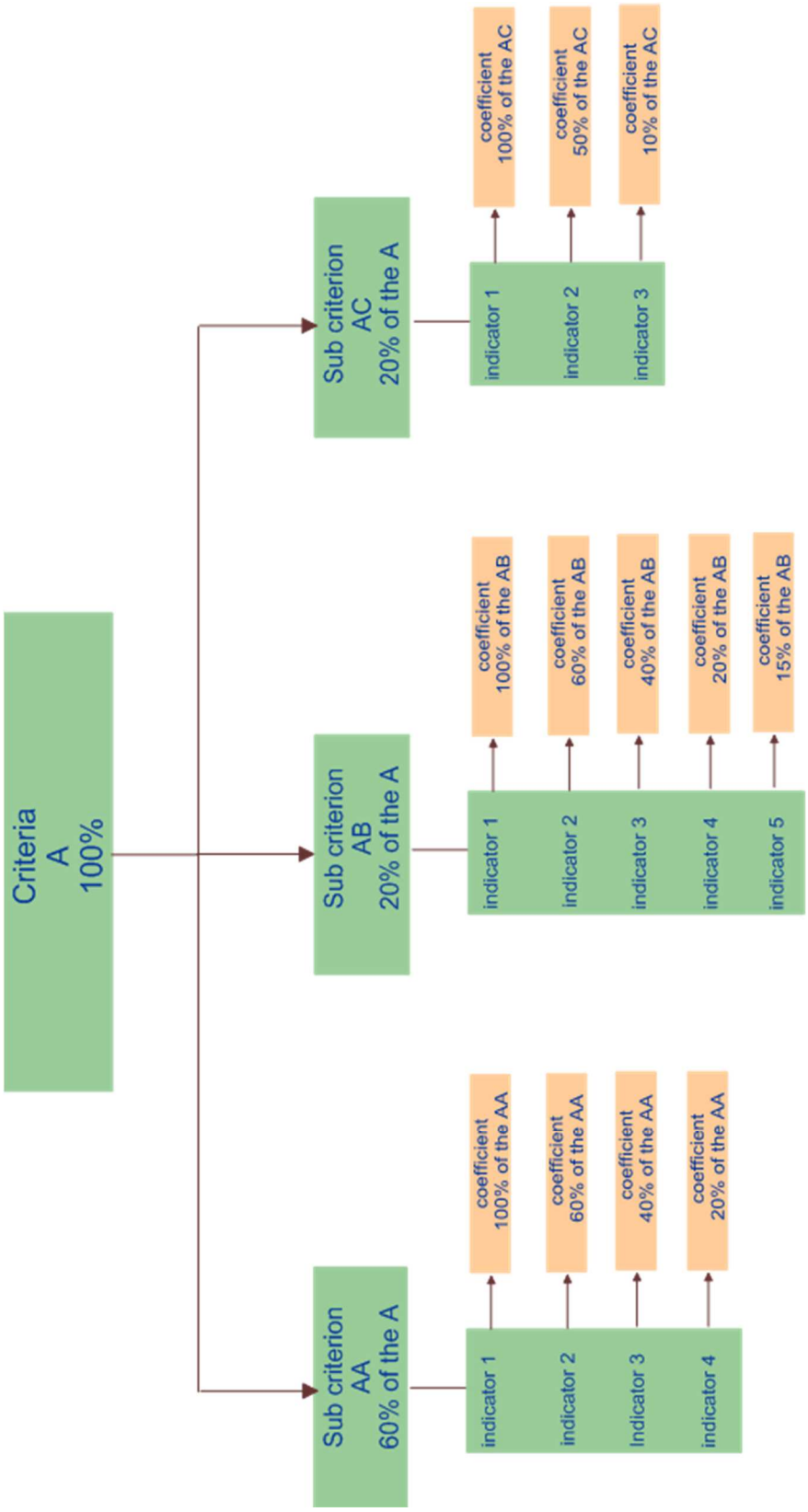
In this case, sub criterion "Potential to utilize in construction" is defined by four indicators, each corresponding to a certain numerical coefficient.

The value of the numerical coefficients is determined by the total amount (weight) of the respective sub criterion and is distributed according to the weight of the indicator.

As a general rule, an approach is adopted, where the maximum value of the numerical coefficient may not exceed the maximum value (weight) of the respective sub criterion.

In the example above, sub criterion “Potential to utilize in construction” gets 60 % or 1.2. of the total value (weight) of the main criterion, consequently the numeric coefficients, describing the evaluation indicators have the following distribution:

Criteria		Indicator	Coefficient
Waste Ws – 2.0			
Possibility for use in construction, 60% (1.2)	Wr	≤ 30	0.12 (10% of the 1.2)
		30 – 50	0.48 (40% of the 1.2)
		50 – 70	0.72 (60% of the 1.2)
		> 70	1.20 (100%)


Criteria
A
100%
Sub criterion
AA
60% of the A
indicator 1
indicator 2
Indicator 3
indicator 4
coefficient
100% of the AA
coefficient
60% of the AA
coefficient
40% of the AA
coefficient
20% of the AA
Sub criterion
AB
20% of the A
indicator 1
indicator 2
indicator 3
indicator 4
indicator 5
coefficient
100% of the AB
coefficient
60% of the AB
coefficient
40% of the AB
coefficient
20% of the AB
coefficient
15% of the AB
Sub criterion
AC
20% of the A
indicator 1
indicator 2
indicator 3
coefficient
100% of the AC
coefficient
50% of the AC
coefficient
10% of the AC

II. Multi-criteria analysis

Essentially, the assessment is perform in two main stages / evaluation period:

- Consruction period;
- Operation period.

2.1. CONSTRUCTION PERIOD

Air Quality – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Air Quality – 2.0				
Affected settlements (pcs.)	R	≤ 2	2.0	(R / Δm) - Δt
		2 – 5	1.5	
		5 – 10	1.0	
		> 10	0.5	
Distance of the nearest village, to the construction site (m)	Δm	≤ 200	3.0	
		200 – 500	2.0	
		500 – 1000	1.5	
		> 1000	1.0	
Duration of the construction period (years)	Δt	≤ 1	0.0	
		2 – 5	0.1	
		> 6	0.2	

Water Quality – value 2.0

Criteria		Indicator	Coefficient	Algorithm		
Water Quality – 2.0 (50%/50%)						
Surface water, P_{SW} – 1.0 (50%)						
Risk of contamination of surface water, R_{pol} – 0.6 (60%)				$R_{pol} = Sr + Cp + Ks$	$P_{SW} = R_{pol} + R_{flow}$	$R_{SW} + R_{GW}$
Affected surface water bodies – 0.36 (60%)	Sr	yes	0.0			
		no	0.36			
Potentially lowering the drainage capacity – 0.12 (20%)	Cp	yes	0.0			
		no	0.12			
Category of the water body – 0.12 (20%)	Ks	I	0.012			
		II	0.07			
		III	0.12			
Risk of flood, R_{flow} – 0.4 (40%)				$R_{flow} = R$		
Degree of flood risk	R	high	0.04			
		moderate	0.16			
		low	0.40			

Ground water, P_{GW} – 1.0 (50%)						
Risk of contamination of ground water, R_{pol} – 1.0				$R_{pol} = S_{WB} + S_{zone}$	$P_{GW} = R_{pol}$	
Groundwater status (1-st aquifer)	S_{WB}	critical	0.04			
		at risk	0.16			
		good	0.40			
Affected sanitary protection zones (number)	S_{zone}	no	0.6			
		1 – 2	0.36			
		2 – 4	0.24			
		> 4	0.06			

Acoustic environment – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Noise, Ac – 2.0				
Predicted noise levels at the points of impact (Lday dB(A))	L_{day}	≤ 50	2.0	$Ac = L_{day}$
		50 – 60	1.2	
		60 – 62	1.0	
		62 – 65	0.8	
		> 65	0.2	

Visual impact/Landscape – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Landscape, L – 1.0				
Landscape feature – 0.5 (50%)	Ls	positive	0.5	L = Ls + Vi
		negative	0.05	
Visual effects – 0.5 (50%)	Vi	acceptable	0.5	
		unacceptable	0.05	

Soils and uncultivated lands – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Soils and uncultivated lands, S_L – 2.0				
Area of the Permanent works, with permanent change in its purpose (road envelope) (dka), 80%	Ar	≤ 500	1.60	S_L = Ar+Aw
		500– 1000	0.96	
		1000 – 2000	0.64	
		2000 – 4000	0.32	
		> 4000	0.16	
Areas for permanent storage of excavated spoil - construction landfills (dka), 20%	Aw	≤ 10	0.4	
		10 – 50	0.32	
		50 – 100	0.26	
		100 – 200	0.16	
		200 – 400	0.08	
		400 – 600	0.04	
		> 600	0.02	

Agricultural lands – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Agricultural lands, Ag – 1.0				
Affected agricultural land (dka)	Agl	≤ 100	1.0	Ag = Agl
		100 – 200	0.8	
		200 – 400	0.6	
		400 – 600	0.4	
		600 – 800	0.2	
		800 - 1000	0.15	
		1000 - 1200	0.10	
		> 1200	0.05	

Waste – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Waste material, Ws – 2.0				
Amount of redundant excavated spoil, 40%	Wq	≤ 500 thous.	0.80	Ws = Wq+Wr
		500 thous - 1mln.	0.64	
		1mln. – 2mln.	0.48	
		2mln. – 4mln.	0.32	
		> 4mln.	0.08	
Possibility for use in construction, 60%	Wr	≤ 30	0.12	
		30 – 50	0.48	
		50 – 70	0.72	
		> 70	1.20	

Social Effect – value 2.0

Criteria		Indicator		Coefficient	Algorithm
People and Communities, D – 2.0					
Need to reorganize the traffic	Ds	yes	≤ 1	1.5	D = Ds – T If Ds = "no", then D = 2.0
			1 –2	1.0	
			2 –4	0.8	
			> 4	0.6	
		no		2.0	
Duration of the construction period (years)	T	≤ 1		0.1	
		1 – 2		0.2	
		2 – 4		0.3	
		4 – 6		0.4	
		> 6		0.5	

Natura 2000 sites – value 4.0

<table>
<tr><th>Criteria</th><th></th><th>Indicator</th><th>Coefficient</th><th>Algorithm</th><th></th><th></th></tr>
<tr><td colspan="7">Natura 2000 – 4.0</td></tr>
<tr><td colspan="4">PROTECTED AREAS/HABITATS, P_{AH} – 2.0 (50%)</td><td rowspan="13">$P_A = Pt + In + Aa$</td><td rowspan="28">$P_{AH} = P_A + N_H + S_H$</td><td rowspan="28">$P_{AH} + Aa$</td></tr>
<tr><td colspan="4">Protected areas, P_A – 1.0 (50%)</td></tr>
<tr><td rowspan="3">Affected protected areas, 20%</td><td rowspan="3">Pt</td><td>1</td><td>0.20</td></tr>
<tr><td>2 – 5</td><td>0.10</td></tr>
<tr><td>> 5</td><td>0.04</td></tr>
<tr><td rowspan="4">Type of influence, 40%</td><td rowspan="4">In</td><td>Direct and permanent</td><td>0.04</td></tr>
<tr><td>Direct and temporary</td><td>0.16</td></tr>
<tr><td>Indirect and permanent</td><td>0.24</td></tr>
<tr><td>Indirect and temporary</td><td>0.40</td></tr>
<tr><td rowspan="3">Scope of affected protected areas, 40%</td><td rowspan="3">Aa</td><td>≤ 0.1</td><td>0.40</td></tr>
<tr><td>0.2 – 0.5</td><td>0.20</td></tr>
<tr><td>> 0.5</td><td>0.08</td></tr>
<tr><td colspan="4">Natural habitats, N_H – 0.5 (25%)</td><td rowspan="15">$N_H = H + At + Fr + Im + Pr + Ss$</td></tr>
<tr><td colspan="4">Module 1 – 0.3 (30%)</td></tr>
<tr><td rowspan="3">Affected natural habitats, 25%</td><td rowspan="3">H</td><td>1</td><td>0.075</td></tr>
<tr><td>2 – 5</td><td>0.037</td></tr>
<tr><td>> 5</td><td>0.015</td></tr>
<tr><td rowspan="3">Affected natural habitats, subject of conservation in the SCI, 50%</td><td rowspan="3">At</td><td>≤ 0.1</td><td>0.15</td></tr>
<tr><td>0.2 – 0.5</td><td>0.075</td></tr>
<tr><td>> 0.5</td><td>0.030</td></tr>
<tr><td rowspan="3">Fragmentation, 25%</td><td rowspan="3">Fr</td><td>1</td><td>0.075</td></tr>
<tr><td>2 – 5</td><td>0.037</td></tr>
<tr><td>> 5</td><td>0.015</td></tr>
<tr><td colspan="4">Module 2 – 0.7 (70%)</td></tr>
<tr><td rowspan="4">Type of influence, 20%</td><td rowspan="4">Im</td><td>Direct and permanent</td><td>0.014</td></tr>
<tr><td>Direct and temporary</td><td>0.056</td></tr>
<tr><td>Indirect and permanent</td><td>0.084</td></tr>
<tr><td>Indirect and temporary</td><td>0.14</td></tr>
<tr><td rowspan="2">Priority, (50%)</td><td rowspan="2">Pr</td><td>Priority</td><td>0.035</td></tr>
<tr><td>Non-priority</td><td>0.35</td></tr>
<tr><td rowspan="3">Conservation status, 30%</td><td rowspan="3">Ss</td><td>Adverse bad</td><td>0.021</td></tr>
<tr><td>Adverse unsatisf.</td><td>0.10</td></tr>
<tr><td>Good</td><td>0.21</td></tr>
</table>

Habitats of spacies, S_H – 0.5 (25%)				$S_H = Af + Aa + Fr + Pr + Im + St + Am$		
Module 1 – 0.2 (20%)						
Affected habitats of spaces, subject of conservation in the SCI, 25%	Af	≤ 5	0.05			
		5 – 10	0.03			
		10 – 15	0.02			
		> 15	0.005			
Affected areas, 50%	Aa	≤ 0.1	0.1			
		0.2 – 0.5	0.05			
		> 0.5	0.02			
Fragmentation, 25%	Fr	1	0.05			
		2 – 5	0.025			
		> 5	0.01			
Module 2 – 0.8 (80%)						
Priority, 50%	Pr	Priority	0.04			
		Non-priority	0.4			
Type of influence, 15%	Im	Direct and permanent	0.012			
		Direct and temporary	0.048			
		Indirect and permanent	0.072			
		Indirect and temporary	0.12			
Conservation status, 25%	St	Adverse bad	0.02			
		Adverse unsatisf.	0.10			
		Good	0.20			
Risk of animal mortality, 10%	Am	High	0.008			
		Moderate	0.04			
		Low	0.08			
PROTECTED AREAS FOR CONSERVATION OF WILD BIRDS, Aa – 2.0 (50%)				$Pav = Xa + Im + At$	$Aa = Pav + Aav$	
Protected areas, Pav – 0.3 (20%)						
Number of affected protected areas, 20%	Xa	1	0.06			
		2 – 5	0.03			
		> 5	0.012			
Type of influence, 40%	Im	Direct and permanent	0.012			
		Direct and temporary	0.048			
		Indirect and permanent	0.072			
		Indirect and temporary	0.12			
Percentage of affected protected areas, 40%	At	≤ 0.1	0.12			
		0.2 – 0.5	0.06			
		> 0.5	0.024			

Habitats of spaces, Aav – 1.2 (80%)				Aav = Ya + At + Fr + Am + Ss + In		
Module 1 – 0.36 (30%)						
Affected habitats of spaces, 20%	Ya	≤ 5	0.072			
		5 – 10	0.043			
		10 – 15	0.030			
		> 15	0.007			
Percentage of affected protected areas, 50%	At	≤ 0.1	0.18			
		0.2 – 0.5	0.09			
		> 0.5	0.036			
Fragmentation, 20%	Fr	1	0.072			
		2 – 5	0.036			
		> 5	0.014			
Risk of animal mortality, 10%	Am	High	0.0036			
		Moderate	0.018			
		Low	0.036			
Module 2 – 0.84 (70%)						
Type of influence, 20%	Ss	Direct and permanent	0.017			
		Direct and temporary	0.068			
		Indirect and permanent	0.10			
		Indirect and temporary	0.17			
Vulnerability, 80%	In	Threatened	0.067			
		Low threatened	0.33			
		Not threatened	0.67			

Biodiversity and Protected areas – 4.0

Criteria		Indicator	Coefficient	Algorithm
Biodiversity and Protected areas, P_{SH} – 4.0 (100%)				P_{SH} = At + In + Aa + Cr
Affected protected areas, 20%	At	1	0.8	
		2 – 5	0.4	
		> 5	0.16	
Type of influence, 20%	In	Dir. and perm.	0.08	
		Dir. and temp.	0.32	
		Indir. and perm.	0.48	
		Indir. and temp.	0.8	
Percentage of the areas affected by the zone, 50%	Aa	≤ 0.1	2.0	
		0.2 – 0.5	1.0	
		> 0.5	0.4	
Need to change the area / regime of the protected area, 10%	Cr	Yes	0.04	
		No	0.4	

2.2. OPERATION PERIOD

Air Quality – value 1.0

Criteria		Indicator	Coefficient	Algorithm	
Mass load of pollutants, M – 0.4 (40%)				$M = M_{max} - (\Sigma E_{(NOx)}+E_{(CO)}+E_{(PM)})$ $M_{max} = 0.4$	M + Dis
Inventory of pollutants	E	Quantity of pollutants in Mg	-		
Dispersion of pollutants, Dis – 0.6 (60%)				$Dis = C_{max} + \Delta m + R$	
Concentration of pollutant at the points of impact , µg – 0.36 (60%)	C_{max}	≤ 30	0.36		
		30 – 40	0.18		
		> 40	0.036		
Distance of the nearest village , m – 0.12 (20%)	Δm	≤ 50	0.012		
		50 – 100	0.024		
		100 – 200	0.048		
		200 – 500	0.072		
		500 – 1000	0.096		
		> 1000	0.12		
Affected villages, pcs. – 0.12 (20%)	R	≤ 2	0.12		
		2 – 5	0.072		
		5 – 10	0.048		
		> 10	0.012		

Climate change – value 2.0

Criteria		Indicator	Coefficient	Algorithm	
Mass of greenhouse gases released, GWm – 0.8 (40%)				$GWm = GWm_{max} - (\Sigma E_{(CO2)}+E_{(N2O)}+E_{(CH4)})$	GWm + GWp
Inventory of greenhouse gases	E	Quantity of greenhouse gases, Mg	-		

Global warming, GWp – 1.2 (60%)				Meqv = GWp(k) * M_{GW}/1000 GWp = Meqv	
Potential of greenhouse gases	M_{eqv}	Potential of greenhouse gases, kgeqvCO_2	-		

Water Quality – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Degree of surface water risk	R_{SW}	acceptable	0.5	$R = R_{SW} + R_{GW}$
		unacceptable	0.05	
Degree of ground water risk	R_{GW}	acceptable	0.5	
		unacceptable	0.05	

Criteria		Indicator	Coefficient	Algorithm		
Surface water, P_{SW} – 0.5 (50%)						$P_{SW} + P_{GW}$
Risk of polluting surface waters during accidents, P_{inc}						
Annual probability of a spillage with the potential to cause a serious pollution incident, Pspl				$R_{spl} = RL \times SS \times (AADT \times 365 \times 10^{-9}) \times (HGW/100)$	$P_{inc} = P_{psl} + P_{pol}$ $R_{SW} = P_{inc}$	
Road length	RL	km	-			
Spillage rates	SS	No Junction	0.36			
		Slip Road	0.43			
		Roundabout	3.0			
Annual average daily traffic	AADT	AADT	-			
Percentage of heavy goods vehicles	HGW	%	-			

The probability, given a spillage, that a serious pollution incident will result, Ppol				P_{pol} = Rt		
Distance of the emergency services and response time to site	Rt	Urban (response time to site <20 minutes)	0.45			
		Rural (response time to site <1 hour)	0.60			
		Remote (response time to site >1 hour)	0.75			
Ground water, P_{GW} – 0.5 (50%)						
Risk of polluting ground waters during accidents, P_{inc}						
Annual probability of a spillage with the potential to cause a serious pollution incident, Pspl				R_{spl} = RL x SS x (AADT x 365 x 10^{-9}) x (HGW/100)	P_{inc} = P_{psl} + P_{pol}	
Road length	RL	km	-			
Spillage rates	SS	No Junction	0.36			
		Slip Road	0.43			
		Roundabout	3.0			
Annual average daily traffic	AADT	AADT	-			
Percentage of heavy goods vehicles	HGW	%	-			
The probability, given a spillage, that a serious pollution incident will result, Ppol				P_{pol} = Rt		
Distance of the emergency services and response time to site	Rt	Urban (response time to site <20 minutes)	0.3			
		Rural (response time to site <1 hour)	0.3			

		Remote (response time to site >1 hour)	0.5			

Assessment matrix on degree of risk - P_{inc}	
Value	**Degree of risk**
≤ 1.0	Acceptable risk
> 1.0	Potential risk

Acoustic environment (Noise) – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Acoustic environment, Ac – 1.0 (100%)				$Ac = L_{day}$
Predicted noise levels at the points of impact, dB(A)	L_{day}	≤ 50	1.0	
		50 – 60	0.6	
		60 – 62	0.5	
		62 – 65	0.4	
		> 65	0.1	

Natura 2000 sites – value 3.0

Criteria		Indicator	Coefficient	Algorithm		
Natura 2000 – 3.0						
PROTECTED AREAS/HABITATS, P_{AH} – 1.5 (50%)				$P_A = Pt + In + Aa$	$P_{AH} = P_A + N_H + S_H$	$P_{AH} + Aa$
Protected areas, P_A – 0.75 (50%)						
Affected protected areas, 20%	Pt	1	0.15			
		2 – 5	0.075			
		> 5	0.03			
Type of influence, 40%	In	Direct and permanent	0.03			
		Direct and temporary	0.12			
		Indirect and permanent	0.18			
		Indirect and temporary	0.3			
Scope of affected protected areas, 40%	Aa	≤ 0.1	0.3			
		0.2 – 0.5	0.15			
		> 0.5	0.06			

Natural habitats N_H – 0.37 (25%)				$N_H = H + At + Fr + Im + Pr + Ss$		
Module 1 – 0.11 (30%)						
Affected natural habitats, 25%	H	1	0.027			
		2 – 5	0.014			
		> 5	0.0054			
Affected natural habitats, subject of conservation in the SCI, 50%	At	≤ 0.1	0.055			
		0.2 – 0.5	0.027			
		> 0.5	0.011			
Fragmentation, 25%	Fr	1	0.027			
		2 – 5	0.014			
		> 5	0.0054			
Module 2 – 0.26 (70%)						
Type of influence, 20%	Im	Direct and permanent	0.0052			
		Direct and temporary	0.021			
		Indirect and permanent	0.031			
		Indirect and temporary	0.052			
Priority, (50%)	Pr	Priority	0.0013			
		Non-priority	0.13			
Conservation status, 30%	Ss	Adverse bad	0.0078			
		Adverse unsatisf.	0.039			
		Good	0.078			
Habitat of species, S_H – 0.37 (25%)				$S_H = Af + Aa + Fr + Pr + Im + Ss$		
Module 1 – 0.07 (20%)						
Affected habitats of spaces, subject of conservation in the SCI, 25%	Af	≤ 5	0.017			
		5 – 10	0.010			
		10 – 15	0.007			
		> 15	0.0017			
Affected areas, 50%	Aa	≤ 0.1	0.035			
		0.2 – 0.5	0.017			
		> 0.5	0.007			
Fragmentation, 25%	Fr	1	0.017			
		2 – 5	0.008			
		> 5	0.0034			
Module 2 – 0.3 (80%)						
Priority, 50%	Pr	Priority	0.015			
		Non-priority	0.15			
Type of influence, 20%	Im	Direct and permanent	0.006			
		Direct and temporary	0.024			
		Indirect and permanent	0.036			
		Indirect and temporary	0.06			

Conservation status, 30%	Ss	Adverse bad	0.009			
		Adverse unsatisf.	0.045			
		Good	0.09			
PROTECTED AREAS FOR WILD BIRDS, Aa – 1.5 (50%)						
Protected areas, Pav – 0.3 (20%)						
Number of affected protected areas, 20%	Xa	1	0.06	Pav = Xa + Im + At	Aa = Pav + Aav	
		2 – 5	0.03			
		> 5	0.012			
Type of influence, 40%	Im	Direct and permanent	0.012			
		Direct and temporary	0.048			
		Indirect and permanent	0.072			
		Indirect and temporary	0.12			
Percentage of affected protected areas, 40%	At	≤ 0.1	0.12			
		0.2 – 0.5	0.06			
		> 0.5	0.024			
Habitats of spaces, Aav – 1.2 (80%)				Aav = Ya + At + Fr + Ss + In		
Module 1 – 0.36 (30%)						
Affected habitats of spaces, 25%	Ya	≤ 5	0.09			
		5 – 10	0.054			
		10 – 15	0.036			
		> 15	0.009			
Percentage of affected protected areas, 50%	At	≤ 0.1	0.18			
		0.2 – 0.5	0.09			
		> 0.5	0.036			
Fragmentation, 25%	Fr	1	0.09			
		2 – 5	0.045			
		> 5	0.018			
Module 2 – 0.84 (70%)						
Type of influence, 20%	Ss	Direct and permanent	0.017			
		Direct and temporary	0.068			
		Indirect and permanent	0.10			
		Indirect and temporary	0.17			
Vulnerability, 80%	In	Threatened	0.067			
		Low threatened	0.34			
		Not threatened	0.67			

Biodiversity and Protected areas – 3.0

Criteria		Indicator	Coefficient	Algorithm
Biodiversity and Protected areas, P_{SH} – 4.0 (100%)				$P_{SH} = At + In + Aa + Cr$
Affected protected areas, 20%	At	1	0.6	
		2 – 5	0.3	
		> 5	0.12	
Type of influence, 20%	In	Dir. and perm.	0.06	
		Dir. and temp.	0.24	
		Indir. and perm.	0.36	
		Indir. and temp.	0.6	
Percentage of the areas affected by the zone, 50%	Aa	≤ 0.1	1.5	
		0.2 – 0.5	0.75	
		> 0.5	0.3	
Need to change the area / regime of the protected area, 10%	Cr	Yes	0.03	
		No	0.3	

Animal mortality – value 3.0

Criteria		Indicator	Coefficient	Algorithm
Animal mortality, Am – 3.0				
Mortality in vertebrate species – 1.5 (50%)				Am = Db + Da
Mortality risk in groups of species	Db	High	0.15	
		Moderate	0.75	
		Low	1.5	
Mortality in birds – 1.5 (50%)				
Mortality risk in groups of species	Da	High	0.15	
		Moderate	0.75	
		Low	1.5	

Visual Impact/Landscape – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Landscape, L – 2.0 (100%)				L = Ls + Vi
Implementation of landscape management mitigation – 0.8 (40%)	Ls	Yes	0.8	
		No	0.08	
Inscription of elements of road infrastructure in the surrounding terrain – 1.2 (60%)	Vi	acceptable	1.2	
		unacceptable	0.12	

Social effect – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Improve the local economy, public and business sector, Se – 1.0 (100%)				Se = Δt + L
Transport distances – 0.5 (50%)				
Time to move to the community center / location	Δt	Shorter	0.5	
		Longer	0.05	
Accessibility and communication – 0.5 (50%)				
Communication to the community center / location	L	Good	0.5	
		Bad	0.05	

III. Environmental impact assessment (EIA/AA)

The evaluation is performed on the main stages / periods in the realization of linear objects, and includes:

- Construction period;
- Operation period.

3.1. CONSTRUCTION PERIOD

Air Quality – value 2.0

Criteria		Indicator	Coefficient	Algorithm	
Air Quality – 2.0 (50%/50%)					
Construction site, Cw – 1.0 (50%)				(R / Δm) - Δt	Cw + Tv
Affected settlements, (pcs.)	R	≤ 2	1.5		
		2 – 5	1.0		
		5 – 10	0.5		
		> 10	0.2		
Distance of the nearest village, to the construction site, (m)	Δm	≤ 200	3.0		
		200 – 500	2.0		
		500 – 1000	1.5		
		> 1000	1.0		
Duration of the construction period, (years)	Δt	≤ 1	0.0		
		2 – 5	0.1		
		> 6	0.2		
Serving roads, Tv – 1.0 (50%)					
Affected settlements, (pcs.)	R	≤ 2	1.5		
		2 – 5	1.0		
		5 – 10	0.5		
		> 10	0.2		

Distance of the nearest village, to the truck road, (m)	Δm	≤ 200	3.0	(R / Δm) - Δt	
		200 – 500	2.0		
		500 – 1000	1.5		
		> 1000	1.0		
Duration of the construction period, (years)	Δt	≤ 1	0.0		
		2 – 5	0.1		
		> 6	0.2		

Water Quality – value 2.0

Criteria		Indicator	Coefficient	Algorithm		
Water Quality – 2.0 (50%/50%)						
Surface water, P_{SW} – 1.0 (50%)						
Risk of contamination of surface water, R_{pol} – 0.6 (60%)				$R_{pol} = Sr + Cp + Ks$	$P_{SW} = R_{pol} + R_{flow}$	$P_{SW} + P_{GW}$
Affected surface water bodies – 0.36 (60%)	Sr	yes	0.0			
		no	0.36			
Potentially lowering the drainage capacity – 0.12 (20%)	Cp	yes	0.0			
		no	0.12			
Category of the water body – 0.12 (20%)	Ks	I	0.012			
		II	0.07			
		III	0.12			
Risk of flood, R_{flow} – 0.4 (40%)				$R_{flow} = R$		
Degree of flood risk	R	high	0.04			
		moderate	0.16			
		low	0.40			
Ground water, P_{GW} – 1.0 (50%)						
Risk of contamination of ground water, R_{pol} – 1.0				$R_{pol} = S_{WB} + S_{zone}$	$P_{GW} = R_{pol}$	
Groundwater status (1-st aquifer)	S_{WB}	critical	0.04			
		at risk	0.16			
		good	0.40			
Affected sanitary protection zones (number)	S_{zone}	no	0.6			
		1 – 2	0.36			
		2 – 4	0.24			
		> 4	0.06			

Acoustic environment – value 2.0

Criteria		Indicator	Coefficient	Algorithm	
Acoustic environment, Ac – 2.0					$Ac = N_L + Cw + Tv$
Prediction of noise propagation, N_L				$N_L = L_{day}$	
Predicted noise levels at the points of impact, dB(A)	L_{day}	≤ 50	1.4		
		50 – 60	1.2		
		60 – 62	1.0		
		62 – 65	0.8		
		> 65	0.2		
Impact of construction site, Cw				Ri / Δt	
Affected settlements (pcs.)	Ri	≤ 2	0.30		
		2 – 5	0.25		
		5 – 10	0.20		
		> 10	0.15		
Duration of the construction period	Δt	≤ 1	1.0		
		2 – 5	2.0		
		> 6	3.0		
Impact of serving roads, Tv				Ri / Δt	
Affected settlements (pcs.)	Ri	≤ 2	0.30		
		2 – 5	0.25		
		5 – 10	0.20		
		> 10	0.15		
Duration of the construction period	Δt	≤ 1	1.0		
		2 – 5	2.0		
		> 6	3.0		

Soils and uncultivated lands – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Почви и необработваеми земи Ac – 2.0				Ac = Ar + Al + At + Ap + Aw
Area of the Permanent works, with permanent change in its purpose (road envelope), 50%	Ar	≤ 500	1.0	
		500– 1000	0.6	
		1000 – 2000	0.4	
		2000 – 4000	0.2	
		> 4000	0.1	
Areas for construction sites (temporary) without permanent change of use, 5%	Al	≤ 10	0.10	
		10 – 20	0.06	
		20 – 50	0.04	
		> 50	0.01	
Areas of temporary roads 15%	At	≤ 2	0.30	
		2 – 5	0.18	
		5 – 10	0.12	
		10 – 20	0.06	
		> 20	0.03	

Areas for temporary storage of excavated spoil 10%	Ap	≤ 5	0.20	
		5 – 10	0.12	
		10 – 20	0.04	
		> 20	0.02	
Areas for permanent storage of excavated spoil - construction landfills, 20%	Aw	≤ 10	0.4	
		10 – 50	0.32	
		50 – 100	0.24	
		100 – 200	0.16	
		200 – 400	0.08	
		400 – 600	0.04	
		> 600	0.02	

Natura 2000 sites – value 4.0

Criteria		Indicator	Coefficient	Algorithm		
Natura 2000 – 4.0						
PROTECTED AREAS/HABITATS, P_{AH} – 2.0 (50%)				$P_A = Pt + In + Aa$	$P_{AH} = P_A + N_H + S_H$	$P_{AH} + Aa$
Protected areas, P_A – 1.0 (50%)						
Affected protected areas, 20%	Pt	1	0.20			
		2 – 5	0.10			
		> 5	0.04			
Type of influence, 40%	In	Direct and permanent	0.04			
		Direct and temporary	0.16			
		Indirect and permanent	0.24			
		Indirect and temporary	0.40			
Scope of affected protected areas, 40%	Aa	≤ 0.1	0.40			
		0.2 – 0.5	0.20			
		> 0.5	0.08			
Natural habitats, N_H – 0.5 (25%)				$N_H = H + At + Fr + Im + Pr + Ss$		
Module 1 – 0.3 (30%)						
Affected natural habitats, 25%	H	1	0.075			
		2 – 5	0.037			
		> 5	0.015			
Affected natural habitats, subject of conservation in the SCI, 50%	At	≤ 0.1	0.15			
		0.2 – 0.5	0.075			
		> 0.5	0.030			
Fragmentation, 25%	Fr	1	0.075			
		2 – 5	0.037			
		> 5	0.015			
Module 2 – 0.7 (70%)						
Type of influence, 20%	Im	Direct and permanent	0.014			

		Direct and temporary	0.056			
		Indirect and permanent	0.084			
		Indirect and temporary	0.14			
Priority, (50%)	Pr	Priority	0.035			
		Non-priority	0.35			
Conservation status, 30%	Ss	Adverse bad	0.021			
		Adverse unsatisf.	0.10			
		Good	0.21			
Habitats of spacies, S_H – 0.5 (25%)				S_H = Af + Aa + Fr + Pr + Im + St + Am		
Module 1 – 0.2 (20%)						
Affected habitats of spaces, subject of conservation in the SCI, 25%	Af	≤ 5	0.05			
		5 – 10	0.03			
		10 – 15	0.02			
		> 15	0.005			
Affected areas, 50%	Aa	≤ 0.1	0.1			
		0.2 – 0.5	0.05			
		> 0.5	0.02			
Fragmentation, 25%	Fr	1	0.05			
		2 – 5	0.025			
		> 5	0.01			
Module 2 – 0.8 (80%)						
Priority, 50%	Pr	Priority	0.04			
		Non-priority	0.4			
Type of influence, 15%	Im	Direct and permanent	0.012			
		Direct and temporary	0.048			
		Indirect and permanent	0.072			
		Indirect and temporary	0.12			
Conservation status, 25%	St	Adverse bad	0.02			
		Adverse unsatisf.	0.10			
		Good	0.20			
Risk of animal mortality, 10%	Am	High	0.008			
		Moderate	0.04			
		Low	0.08			

PROTECTED AREAS FOR CONSERVATION OF WILD BIRDS, Aa – 2.0 (50%)					
Protected areas, Pav – 0.3 (20%)					
Number of affected protected areas, 20%	Xa	1	0.06	Pav = Xa + Im + At	Aa = Pav + Aav
		2 – 5	0.03		
		> 5	0.012		
Type of influence, 40%	Im	Direct and permanent	0.012		
		Direct and temporary	0.048		
		Indirect and permanent	0.072		
		Indirect and temporary	0.12		
Percentage of affected protected areas, 40%	At	≤ 0.1	0.12		
		0.2 – 0.5	0.06		
		> 0.5	0.024		
Habitats of spaces, Aav – 1.2 (80%)				Aav = Ya + At + Fr + Am + Ss + In	
Module 1 – 0.36 (30%)					
Affected habitats of spaces, 20%	Ya	≤ 5	0.072		
		5 – 10	0.043		
		10 – 15	0.030		
		> 15	0.007		
Percentage of affected protected areas, 50%	At	≤ 0.1	0.18		
		0.2 – 0.5	0.09		
		> 0.5	0.036		
Fragmentation, 20%	Fr	1	0.072		
		2 – 5	0.036		
		> 5	0.014		
Risk of animal mortality, 10%	Am	High	0.0036		
		Moderate	0.018		
		Low	0.036		
Module 2 – 0.84 (70%)					
Type of influence, 20%	Ss	Direct and permanent	0.017		
		Direct and temporary	0.068		
		Indirect and permanent	0.10		
		Indirect and temporary	0.17		
Vulnerability, 80%	In	Threatened	0.067		
		Low threatened	0.33		
		Not threatened	0.67		

Biodiversity and Protected areas – value 4.0

Criteria		Indicator	Coefficient	Algorithm
Biodiversity and Protected areas, P_{SH} – 4.0 (100%)				$P_{SH} = At + In + Aa + Cr$
Affected protected areas, 20%	At	1	0.8	
		2 – 5	0.4	
		> 5	0.16	
Type of influence, 20%	In	Dir. and perm.	0.08	
		Dir. and temp.	0.32	
		Indir. and perm.	0.48	
		Indir. and temp.	0.8	
Percentage of the areas affected by the zone, 50%	Aa	≤ 0.1	2.0	
		0.2 – 0.5	1.0	
		> 0.5	0.4	
Need to change the area / regime of the protected area, 10%	Cr	Yes	0.04	
		No	0.4	

Waste – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Waste material, Ws – 2.0				Ws = Wq+Wr
Amount of redundant excavated spoil, 40%	Wq	≤ 500 thous.	0.80	
		500 thous - 1mln.	0.64	
		1mln. – 2mln.	0.48	
		2mln. – 4mln.	0.32	
		> 4mln.	0.08	
Possibility for use in construction, 60%	Wr	≤ 30	0.12	
		30 – 50	0.48	
		50 – 70	0.72	
		> 70	1.20	

Visual impact/Landscape – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Landscape, L – 1.0				
Landscape feature – 0.5 (50%)	Ls	positive	0.5	L = Ls + Vi
		negative	0.05	
Visual effects – 0.5 (50%)	Vi	acceptable	0.5	
		unacceptable	0.05	

3.2. OPERATION PERIOD

Air Quality – value 1.0

Criteria		Indicator	Coefficient	Algorithm	
Mass of air pollutants, M – 0.4 (40%)				$M = M_{max} - (\Sigma E_{(NOx)} + E_{(CO)} + E_{(PM)})$ $M_{max} = 0.4$	M + Dis
Inventory of pollutants	E	amount of pollutants in Mg	-		
Dispersion of pollutant, Dis – 0.6 (60%)				$Dis = C_{max} + \Delta m + R$	
Concentration of pollutant at the points of impact, µg – 0.36 (60%)	C_{max}	≤ 30	0.36		
		30 – 40	0.18		
		> 40	0.036		
distance to the nearest village, m – 0.12 (20%)	Δm	≤ 50	0.012		
		50 – 100	0.024		
		100 – 200	0.048		
		200 – 500	0.072		
		500 – 1000	0.096		
		> 1000	0.12		
Affected settlements, pcs. – 0.12 (20%)	R	≤ 2	0.12		
		2 – 5	0.072		
		5 – 10	0.048		
		> 10	0.012		

Climate change – value 2.0

Criteria		Indicator	Coefficient	Algorithm	
Mass of greenhouse gases released, GWm – 0.8 (40%)				$GWm = GWm_{max} - (\Sigma E_{(CO2)} + E_{(N2O)} + E_{(CH4)})$	GWm + GWp
Inventory of greenhouse gases	E	Quantity of greenhouse gases, Mg	-		

Global warming, GWp – 1.2 (60%)					
Potential of greenhouse gases	M_{eqv}	Potential of greenhouse gases, kgeqvCO_2	-	Meqv = GWp(k) * M_{GW}/1000 GWp = Meqv	

Water Quality – value 1.0

Criteria		Indicator	Coefficient	Algorithm	
Water Quality – 1.0					
Surface water, P_{SW} – 0.5 (50%)					
Risk of polluting surface waters, Rw – 0.3					
Affected surface water bodies	Iw	Да	-	Rw = (Rt / 0.3) – Cw - Sn - Δm	
		Не	0.3		
Distance to water bodies, м	Δm	Във вод. обект	0.16		
		< 50	0.04		
		50 – 100	0.03		
		100 – 200	0.02		
		200 – 500	0.01		
		> 500	0.0		
Connection to runoff / surface water from the roadway to the water body	Sn	Пряка	0.01		
		Непряка	0.0		
Treatment / purification of surface runoff / surface water from the carriageway before discharge into the hydrographic network	Rt	Без пречистване	0.0		
		Лагуна с биофилтър	0.03		
		Дренажен филтър	0.035		
		Изпарител	0.04		
		Каломаслоуловител	0.05		
		Каломаслоуловител+Изпарител	0.09		
Category of the water body	Cw	I	0.04		
		II	0.02		
		III	0.0		

Risk of polluting surface waters during accidents, P_{inc} – 0.2						P_{SW} + P_{GW}
Annual probability of a spillage with the potential to cause a serious pollution incident, Pspl				R_{spl} = RL x SS x (AADT x 365 x 10^{-9}) x (HGW/100)	$P_{inc} = P_{spl} + P_{pol}$ $R_{SW} = P_{inc}$	
Road length	RL	km	-			
Spillage rates	SS	Прав участък	0.36			
		Аварийна лента	0.43			
		Път със завои	3.0			
Annual average daily traffic	AADT	МПС/24h	-			
Percentage of heavy goods vehicles	HGW	%	-			
The probability, given a spillage, that a serious pollution incident will result, Ppol				P_{pol} = Rt		
Distance of the emergency services and response time to site	Rt	Urban (response time to site <20 minutes)	0.45			
		Rural (response time to site <1 hour)	0.60			
		Remote (response time to site >1 hour)	0.75			
Ground Water, P_{GW} – 0.5 (50%)						
Risk of polluting ground waters, Rgw – 0.3						
Annual average daily traffic	AADT	< 50 000	15	Rgw = AADT + Rf + Ss + Gw + Bw + Fn + Li		
		50 000 - 100 000	30			
		> 100 000	45			
Rainfall volume (annual average), mm	Rf	< 550	15			
		550 – 700	30			
		100 – 200	45			
Soakaway geometry	Ss	Continuous linear	15			
		Single point or shallow soakaway serving low road area	30			
		Single point, deep serving	45			

		high road area > 5000 m2				
Ground water level	Gw	< 5	60			
		5 – 15	40			
		> 15	20			
Flow type	Bw	Heavy consolidated sedimentary deposits	20			
		Consolidated deposits	40			
		Unconsolidated deposits	60			
Effective grain size	Fn	Fine sand	7.5			
		Coarse sand	15			
		Very coarse sand	22.5			
Litology	Li	< 1% clay	22.5			
		1 - 5% clay	15			
		> 15% clay	7.5			
Risk of polluting ground waters during accidents, P_{inc}						
Annual probability of a spillage with the potential to cause a serious pollution incident, Pspl				$R_{spl} = RL \times SS \times (AADT \times 365 \times 10^{-9}) \times (HGW/100)$	$P_{inc} = P_{spl} + P_{pol}$ $R_{GW} = P_{inc}$	
Road length	RL	km	-			
Spillage rates	SS	No Junction	0.36			
		Slip Road	0.43			
		Roundabout	3.0			
Annual average daily traffic	AADT	AADT	-			
Percentage of heavy goods vehicles	HGW	%	-			
The probability, given a spillage, that a serious pollution incident will result, Ppol				$P_{pol} = Rt$		
Distance of the emergency services and response time to site	Rt	Urban (response time to site <20 minutes)	0.3			
		Rural (response time to site <1 hour)	0.3			

		Remote (response time to site >1 hour)	0.5			

Criteria		Indicator	Coefficient	Algorithm
Degree of ground water risk	R_{gw}	Low risk ($R_{gw} \leq 150$)	0.3	$R = R_{gw}$
		Moderate risk (R_{gw} =150 - 250)	0.15	
		High risk ($R_{gw} > 250$)	0.0	

Criteria		Indicator	Coefficient	Algorithm
Degree of surface water risk during accidents	R_{SW}	Acceptable ($P_{inc} \leq 1.0$)	0.2	$R = R_{SW} + R_{GW}$
		Potential ($P_{inc} > 1.0$)	0.02	
Degree of ground water risk during accidents	R_{GW}	Acceptable ($P_{inc} \leq 1.0$)	0.2	
		Potential ($P_{inc} > 1.0$)	0.02	

Assessment matrix on degree of ground water risk - R_{gw}	
Value	**Degree of risk**
≤ 150	Low risk
150 - 250	Moderate risk
> 250	High risk

Assessment matrix on degree of risk during accident - P_{inc}	
Value	**Degree of risk**
≤ 1.0	Acceptable risk
> 1.0	Potential risk

Acoustic environment – value 1.0

Criteria		Indicator	Coefficient	Algorithm
Acoustic environment, Ac – 1.0 (100%)				$Ac = (L_{day} + S_{set}) - R$
Predicted noise levels at the points of impact dB(A), 80%	L_{day}	≤ 50	0.8	
		50 – 60	0.6	
		60 – 62	0.4	
		62 – 65	0.2	
		> 65	0.1	
Affected settlements (pcs.), 20%	S_{set}	≤ 2	0.20	
		2 – 5	0.15	
		5 - 10	0.10	
		> 10	0.05	
Affected areas with special protection regime	R	Да	0.1	
		Не	0.0	

Visual Impact/Landscape – value 2.0

Criteria		Indicator	Coefficient	Algorithm
Landscape, L – 2.0 (100%)				L = Ls + Vi
Implementation of landscape management mitigation – 0.8 (40%)	Ls	Yes	0.8	
		No	0.08	
Inscription of elements of road infrastructure in the surrounding terrain – 1.2 (60%)	Vi	acceptable	1.2	
		unacceptable	0.12	

Natura 2000 sites – value 3.0

Criteria		Indicator	Coefficient	Algorithm		
Natura 2000 – 3.0						
PROTECTED AREAS/HABITATS, P_{AH} – 1.5 (50%)				$P_A = Pt + In + Aa$	$P_{AH} = P_A + N_H + S_H$	$P_{AH} + Aa$
Protected areas, P_A – 0.75 (50%)						
Affected protected areas, 20%	Pt	1	0.15			
		2 – 5	0.075			
		> 5	0.03			
Type of influence, 40%	In	Direct and permanent	0.03			
		Direct and temporary	0.12			
		Indirect and permanent	0.18			
		Indirect and temporary	0.3			
Scope of affected protected areas, 40%	Aa	≤ 0.1	0.3			
		0.2 – 0.5	0.15			
		> 0.5	0.06			

Natural habitats N_H – 0.37 (25%)				$N_H = H + At + Fr + Im + Pr + Ss$		
Module 1 – 0.11 (30%)						
Affected natural habitats, 25%	H	1	0.027			
		2 – 5	0.014			
		> 5	0.0054			
Affected natural habitats, subject of conservation in the SCI, 50%	At	≤ 0.1	0.055			
		0.2 – 0.5	0.027			
		> 0.5	0.011			
Fragmentation, 25%	Fr	1	0.027			
		2 – 5	0.014			
		> 5	0.0054			
Module 2 – 0.26 (70%)						
Type of influence, 20%	Im	Direct and permanent	0.0052			
		Direct and temporary	0.021			
		Indirect and permanent	0.031			
		Indirect and temporary	0.052			
Priority, (50%)	Pr	Priority	0.0013			
		Non-priority	0.13			
Conservation status, 30%	Ss	Adverse bad	0.0078			
		Adverse unsatisf.	0.039			
		Good	0.078			
Habitat of species, S_H – 0.37 (25%)				$S_H = Af + Aa + Fr + Pr + Im + Ss$		
Module 1 – 0.07 (20%)						
Affected habitats of spaces, subject of conservation in the SCI, 25%	Af	≤ 5	0.017			
		5 – 10	0.010			
		10 – 15	0.007			
		> 15	0.0017			
Affected areas, 50%	Aa	≤ 0.1	0.035			
		0.2 – 0.5	0.017			
		> 0.5	0.007			
Fragmentation, 25%	Fr	1	0.017			
		2 – 5	0.008			
		> 5	0.0034			
Module 2 – 0.3 (80%)						
Priority, 50%	Pr	Priority	0.015			
		Non-priority	0.15			
Type of influence, 20%	Im	Direct and permanent	0.006			
		Direct and temporary	0.024			
		Indirect and permanent	0.036			
		Indirect and temporary	0.06			

Conservation status, 30%	Ss	Adverse bad	0.009			
		Adverse unsatisf.	0.045			
		Good	0.09			
PROTECTED AREAS FOR WILD BIRDS, Aa – 1.5 (50%)						
Protected areas, Pav – 0.3 (20%)						
Number of affected protected areas, 20%	Xa	1	0.06	Pav = Xa + Im + At	Aa = Pav + Aav	
		2 – 5	0.03			
		> 5	0.012			
Type of influence, 40%	Im	Direct and permanent	0.012			
		Direct and temporary	0.048			
		Indirect and permanent	0.072			
		Indirect and temporary	0.12			
Percentage of affected protected areas, 40%	At	≤ 0.1	0.12			
		0.2 – 0.5	0.06			
		> 0.5	0.024			
Habitats of spaces, Aav – 1.2 (80%)				Aav = Ya + At + Fr + Ss + In		
Module 1 – 0.36 (30%)						
Affected habitats of spaces, 25%	Ya	≤ 5	0.09			
		5 – 10	0.054			
		10 – 15	0.036			
		> 15	0.009			
Percentage of affected protected areas, 50%	At	≤ 0.1	0.18			
		0.2 – 0.5	0.09			
		> 0.5	0.036			
Fragmentation, 25%	Fr	1	0.09			
		2 – 5	0.045			
		> 5	0.018			
Module 2 – 0.84 (70%)						
Type of influence, 20%	Ss	Direct and permanent	0.017			
		Direct and temporary	0.068			
		Indirect and permanent	0.10			
		Indirect and temporary	0.17			
Vulnerability, 80%	In	Threatened	0.067			
		Low threatened	0.34			
		Not threatened	0.67			

Biodiversity and Protected areas – value 3.0

Criteria		Indicator	Coefficient	Algorithm
Biodiversity and Protected areas, P_{SH} – 4.0 (100%)				$P_{SH} = At + In + Aa + Cr$
Affected protected areas, 20%	At	1	0.6	
		2 – 5	0.3	
		> 5	0.12	
Type of influence, 20%	In	Dir. and perm.	0.06	
		Dir. and temp.	0.24	
		Indir. and perm.	0.36	
		Indir. and temp.	0.6	
Percentage of the areas affected by the zone, 50%	Aa	≤ 0.1	1.5	
		0.2 – 0.5	0.75	
		> 0.5	0.3	
Need to change the area / regime of the protected area, 10%	Cr	Yes	0.03	
		No	0.3	

Animal mortality – value 3.0

Criteria		Indicator	Coefficient	Algorithm
Animal mortality, Am – 3.0				
Mortality in vertebrate species – 1.5 (50%)				Am = Db + Da
Mortality risk in groups of species	Db	High	0.15	
		Moderate	0.75	
		Low	1.5	
Mortality in birds – 1.5 (50%)				
Mortality risk in groups of species	Da	High	0.15	
		Moderate	0.75	
		Low	1.5	

Notes

Notes